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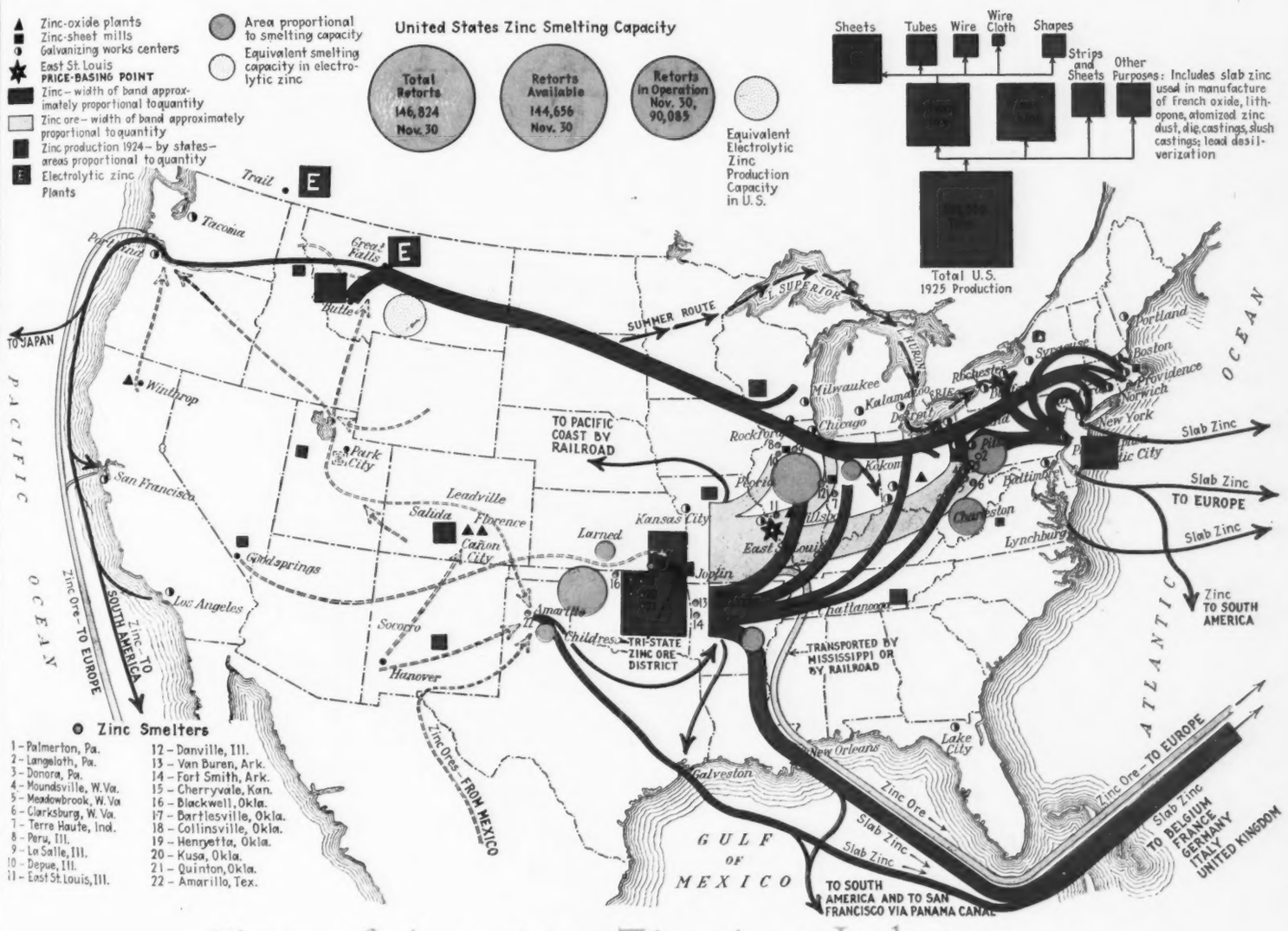

Flow of American Zinc into Industry

And to Foreign Countries

Progress of Mining in 1925

Major Metals — Minor Metals — Non-Metallics
Technical Developments
Regional Summaries — Current Problems
New Machinery — Marketing — Statistics

Mining Stocks—Week Ended January 2, 1926

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	50⅛	49¼	49⅞	Ja.16,Fe.23,Q	0.75
Arcadian Consol.	Boston	*62	*55	*62		
Ariz. Com'l	Boston	12⅛	12⅛	12⅜	Jy.21, Jy. 31 SA	0.50
Calaveras	N. Y. Curb	3⅛	3⅛	3⅛		
Calumet & Arizona	New York	62⅜	57⅞	62⅛	De.4, De.21 QX	1.50
Calumet & Hecla	Boston	14⅜	13⅛	14	Nov 30,De.15 Q	0.50
Cerro de Pasco	New York	63⅛	61½	62	De.10, De.22,X	1.00
Chile Copper	New York	35⅜	33⅜	35	Dec.2, Dec.28, Q	0.62½
Chino	New York	19½	19¼	19¼	Sept., 1920	0.37½
Con. Coppermines	N. Y. Curb	2⅜	1⅞	2⅛		
Copper Range	Boston	18⅜	18	18⅜	May, 1925	1.00
Crystal Copper	Boston Curb	*58	*46	*56		
East Butte	Boston	3⅞	3⅜	3⅜	Dec., 1919	0.50
First National	Boston Curb	*21	*21	*21	Feb., 1919	0.15
Franklin	New York	*90	*50	*55		
Granby Consol.	New York	21	20½	21	May, 1919	1.25
Greene-Cananea	New York	12⅞	12	12⅜	Nov., 1920	0.50
Hancock	Boston	*80	*80	*80		
HoweSound.new,r.t.c.	New York	28⅛	26⅜	28⅛	Oc.5, Oc. 15 Q	0.50
Inspiration Consl.	New York	25½	24	25⅜	De.17, Ja.4, Q	0.50
Iron Cap	Boston Curb	2⅜	2⅛	2⅜	May, 1923	0.15
Isle Royale	Boston	12⅛	11⅞	11⅞	No. 30, De.5	1.00
Jerome Verde Dev.	N. Y. Curb	*90	*83	*84		
Kennecott	New York	57	54½	54⅞	De.4,Jan.2 Q	1.00
Lake Copper	Boston	1⅛	1	1	June, 1925	0.50
Magma Copper	New York	43⅜	42⅜	42½	De.31, Ja.15,	0.75
Mason Valley	N. Y. Curb	2⅛	2	2		
Mass Consolidated	Boston	*55	*50	*50	Nov., 1917	1.00
Miami Copper	New York	12⅞	12	12	No.2, No.16 Q	0.25
Mohawk	Boston	33	32⅛	33	Oc.31, De.2	1.00
Mother Lode Coa.	New York	7⅛	7	7⅛	De. 11, De. 31	0.37½
Nevada Consol.	New York	13⅜	12⅞	13⅜	De. 18, De.31 Q	0.25
New Cornelia	Boston	20	19	19⅞	No.6, No.23 Q	0.25
North Butte	Boston	3⅜	2⅛	3⅜	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*75	*60	*61	No. 14, De. 2	0.05
Old Dominion	Boston	17⅜	16⅞	17	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†126	†124		De.21, Ja.2 Q	1.00
Quincy	Boston	22	21	21½	Mar., 1920	1.00
Ray Consolidated	New York	12⅜	11⅞	12	Dec., 1920	0.25
Ray Hercules	N. Y. Curb			14		
St. Mary's Min. Ld.	Boston	35⅜	35⅛	35⅛	May, 1925	3.00
Seneca Copper	Boston	9⅜	9⅛	9⅜		
Shannon	Boston	*60	*55	*55	Nov., 1917	0.25
Shattuck Arizona	New York	71⅛	68⅛	68½	Jan., 1920	0.25
Superior & Boston	Boston	*75	*75	*75		
Tenn. C. & C.	New York	14½	13⅛	14⅛	De.31, Ja.15,Q	0.25
United Verde Ex.	N. Y. Curb	28	27½	28	Ja.5, Fe.1, Q	0.75
Utah Copper	New York	98	98	98	De.18, De.31, Q	1.25
Utah Metal & T	Boston	*75	*60	*65	Dec., 1917	0.30
Victoria	Boston	*35	*35	*35		
Walker Mining	Salt Lake	...	...	1.55		
NICKEL-COPPER						
Internat. Nickel	New York	45⅜	43⅜	45	De.17,De.31,Q	0.50
Internat. Nickel, pfd.	New York	102	102	102	Oc.15, No.2, Q	1.50
LEAD						
Gladstone M. M. Co.	Spokane	*34	*31	*31	No. 1, No. 10 M	0.01
National Lead	New York	168	165	167⅜	De.11, De.31 Q	2.00
National Lead pfd.	New York	116½	116	116½	Aug.21, Se.15	1.75
St. Joseph Lead	New York	46⅛	45⅜	45⅝	De.10,De.20QX	1.50
ZINC						
Am. Z. L. & S.	New York	8⅜	8⅛	8⅛	May., 1920	1.00
Am. Z. L. & S, pfd.	New York	38⅛	37	37½	Nov., 1920	1.50
Butte C. & Z.	New York	6	5½	5⅝	De.10, De.24	0.50
Butte & Superior	New York	15½	14¼	14⅜	De.15, De.31 Q	0.50
Callahan Zn-Ld	New York	2	2	2	Dec., 1920	0.50
Eagle Picher	Cincinnati	35¼	34	34	De.1, De.31	0.40
Eagle Picher, pfd.	Cincinnati	...	...	110		
New Jersey Zn.	N. Y. Curb	...	...	207½	No.20,Dec.10 X	2.00
United Zinc	N. Y. Curb	...	...	*70		
Yellow Pine	Los Angeles	*40	*30	*40	Se.10 Se.21 Q	0.04
GOLD						
Alaska Juneau	New York	1⅜	1⅛	1⅛		
Argonaut	Toronto	*16½	*15⅞	*16		
Barry-Hollinger	Toronto	*26½	*25½	*25½		
Carson Hill	Boston	*43	*30	*41		
Consol. W. Dome L.	Toronto	*24	*19¾	*23		
Cresson Consol. G.	N. Y. Curb	2⅜	2⅛	2⅜	Se.30, Oc.10	0.10
Crown Reserve	Toronto	*23	*19¾	*23	Jan., 1917	0.05
Dome Mines	New York	17⅛	16⅞	16⅞	De.31, Ja.20, Q	0.50
Golden Cycle	Colo. Springs	†1.60	†1 58		No. 30, Dec. 10 Q	0.03
Hollinger Consol.	Toronto	17.55	17 35	17 50	De.14, De.31	0.08
Homestake Mining	New York	48	48	48	De.19, De.26 M	0.50
Kirkland Lake	Toronto	*87	*83	*85		
Lake Shore	Toronto	9.95	9 40	9 60	De.1,De.15 XQ	0.10
McIntyre-Porcupine	New York	22⅛	22⅛	22⅜	No.2, De.1 Q	0.25
Newray	Toronto	*43	*40	*43		
Night Hawk Pen.	Toronto	*10	*9	*10		
Portland	Colo. Springs	†*63	†*61	...	Oct., 1920	0.01
Rand Mines	New York	33⅛	33¼	33¼	Au.17, Au.25	1.52
Teck-Hughes	Toronto	2.63	2.30	2.63	Ja. 15, Fe. 1	0.05
Tom Reed	Los Angeles	*55	*55	*55	Dec., 1919	0.02
Tough-Oakes	Toronto	*55	*51	*55		
United Eastern	N. Y. Curb			*45	July, 1924	0.05
Vipond Cons.	Toronto	1.61	1.55	1.60		
Wright-Hargreaves	Toronto	8.00	7.75	7.85	De.15, Ja. 1 QX	0.10
GOLD AND SILVER						
Black Oak	N. Y. Curb	...	...	*81		
Carnegie Metals	Pittsburgh	18⅝	18⅛	18⅝		
Con. Cortez	N. Y. Curb	*6	*5	*6		
Con. Virginia	San Francisco	*45	*37½	*37½		
Continental Mines	N. Y. Curb			*45		
Dolores Esperanza	N. Y. Curb	*85	*80	*82	July, 1923	0.05
Premier Gold	N. Y. Curb	2⅛	2⅛	2⅛	De.18, Ja. 4	0.08
Tonopah Belmont	N. Y. Curb	2⅜	2⅛	2⅜	Se.15, Oc.1	0.05
Tonopah Divide	N. Y. Curb			*23	Oct., 1923	0.10
Tonopah Extension	N. Y. Curb	1¾	1⅛	1 1/16	Apr. 1925	0.05
Tonopah Mining	N. Y. Curb	4⅝	4½	4⅜	Se.30, Oc.21	0.07½
Unity Gold	N. Y. Curb	*20	*20	*20		
West End Consol.	N. Y. Curb	*25	*25	*25	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*70	*51	*70	June, 1918	0.02

Stock	Exch.	High	Low	Last		Last Div.
SILVER						
Alvarado	N. Y. Curb	...	...	*76	Oct., 1920	0.50
Beaver Consol	Toronto	...	...	*50	May. 1920	0.03
Castle-Trethewey	Toronto	1.51	1.48	1.50		
Coniagas	Toronto	4.60	4.40	4.60	May, 1924	0.12½
Keeley	Toronto	1.68	1.63	1.67	Au.31,Se.15 X	0.12
Kerr Lake	N. Y. Curb	1⅛	1	1	Oc. 1, Oc.15 Q	0.12½
La Rose	Toronto	*40	*39	*39	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.10	1.10	1.10	Jy. 2, Jy. 15	0.05
McKinley-Dar.-Sav.	Toronto	*25	*24	*25	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.40	3.18	3.21	Ja. 16, Ja.30	0.12½
Nipissing	N. Y. Curb	6⅞	6½	6⅜	De.31, Ja.2, Q	0.15
Temiskaming	Toronto	*14	*13	*14	Jan., 1920	0.40
SILVER-LEAD						
Ahumada	New York	9⅛	8⅞	9	De.15,Ja.2, X	0.25
Alta Merger	Salt Lake	†5	†3			
Bingham Mines	Boston	55⅞	53	54	De.19, De.20 Q	1.00
Cardiff M. & M.	Salt Lake	...	...	*55	De.16, No.18	0.10
Chief Consol	Salt Lake	...	...	3.80	Oc. 10, No. 1	0.10
Emma Silver	Salt Lake	†1½	†1			
Erupcion	Boston Curb	2⅛	1⅞	1⅞	De.15, Ja.2, X	0.10
Federal M. & S.	New York	101	91	101	No.25, De.15 Q	1.75
Federal M. & S., pfd.	New York	101½	98½	101¼	Au.25, Se.15	1.75
Hecla Mining	N. Y. Curb	18	17⅞	18	No.15, De.15 Q	0.50
Iron King Mining	Salt Lake	...	...	*36		
Keystone Mining	Salt Lake	...	...	*63	Au.12, Au.26	0.07½
Lucky Jim	Spokane	*12½	*12½	*12¾		
Mammoth Mining	Salt Lake	...	...	2.80	De. 16, De. 23	0.10
Marsh Mines	Spokane	*7⅛	*6½	*7⅛	Se.15, Oc.1	0.15
Park Utah	Salt Lake	...	...	7.80	Se.15, Oc.1	0.15
Silver King Coal	Salt Lake	...	...	9.55	De.15, Ja.2, QX	0.35
Silversmith	Spokane	*39½	*37½	*39½	De.31, Ja.10	0.02
Tamarack-Custer	Spokane	*36	*35	*35	Sept., 1924	0.25
Tintic Standard	Salt Lake	...	...	13.87½	De.16,De.23,QX	0.50
Utah-Apex	Boston	7⅛	6½	7 1/16	Ja.1, Ja.5, Q	0.35
Western Utah Copper	N. Y. Curb	...	...	*10		
IRON						
Bethlehem Steel	New York	49½	47⅛	48½	July, 1924	1.25
Colorado Fuel & Iron	New York	37⅞	36	36½	May, 1921	0.75
Gt. North'n Iron Ore	New York	26⅜	25½	26⅛	De. 4, De. 28.	0.75
Inland Steel	New York	43½	42½	42½	No.13, De.1 Q	0.62½
Mesabi Iron	N. Y. Curb	1⅜	1⅜	1⅜		
Replogle Steel	New York	15⅝	14⅝	15⅞		
Republic I. & S.	New York	61⅞	59	60	May, 1921	1.50
Republic I. & S. pfd.	New York	94	92⅜	93¾	De.15, Ja.2, Q	1.75
Sloss-Sheffield S. & I.	New York	138	132⅜	135	De.10, De.21 Q	1.50
Sloss-Shef. S.&I. pfd.	New York	...	...	103	De.21, Ja.2, Q	1.75
U. S. Steel	New York	137⅜	134½	136⅝	No.28, De.30 XQ	1.75
U. S. Steel pfd	New York	126¼	125⅛	125⅜	No. 3, No. 28, Q	1.75
Virginia I. C. & C.	New York	...	...	43	Jan., 1924	1.50
Virginia I.C.&C.pfd	New York	...	...	77	De.15, Ja.2,	2.50
VANADIUM						
Vanadium Corp.	New York	32½	31	31½	No.2, No.16 Q	0.50
ASBESTOS						
Asbestos Corp.	Montreal	92½	90½	91½	Se.30, Oc.15 Q	1.50
Asbestos Corp., pfd.	Montreal	115	113¾	114⅝	Se.30, Oc.15, Q	1.50
SULPHUR						
Freeport Texas	New York	21⅜	19½	21	Nov., 1919	1.00
Texas Gulf	New York	122½	117¼	122	De.1, De.15,QX	2.75
DIAMONDS						
De Beers Consol.	New York	29	28½	29	Jy.27, Au.30	0.97
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	5⅞	4⅝	4⅝		
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	54⅜	53½	54⅜	No. 20, De. 1, Q	1.00
Amer. Metal pfd	New York	116⅞	116	116	No. 21, De. 1, Q	1.75
Amer. Sm. & Ref.	New York	144⅜	137⅞	142½	Oc.16, No.2, Q	1.75
Amer. Sm.&Ref.pfd.	New York	113⅞	113½	113¾	No.6, De.1, Q	1.75
Consol. M. & S.	N. Y. Curb	181½	181	181	De.31, Ja.15	0.75
Federated Metals	N. Y. Curb	24	18	18		
Newmont Mining	N. Y. Curb	48	46½	48	De.31, Ja.15,	0.60
Southwest Metals	N. Y. Curb	...	...	2½		
U. S. Sm. R. & M.	New York	51	48⅛	49¼	Ja.1, Ja.7, Q	0.87½
U.S. Sm. R.&M.pfd.	New York	49⅜	49⅛	49⅜	Ja.1, Ja.7, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

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LONDON QUOTATIONS, WEEK ENDED DECEMBER 26, 1925

	High	Low	Last	Date	Per Cent
Aramayo Mines (25 frs.)	80/—	79/ 4½	80/—	Nov. 1925	5(c)
British Platinum	7/6	6/9	7/3	Feb. 1925	2½
Burma Corpn. (10 rupees)	18/10½	18/6	18/7½	Aug. 1925	6 annas.
Bwana M'Kubwa	8/1½	7/½	7/9		
Camp Bird	4/9	4/—	4/7½		
El Oro	5/9	5/3	5/9	Nov. 1924	2½*
Esperanza	1/—	—/9	1/—		
Frontino & Bolivia	8/1½	7/6	7/6	Jan. 1926	1½
Mexican Corporation	21/6	19/9	21/6		
Mexican Mines of El Oro	32/6	31/3	32/6	Dec. 1925	12½*
Nechi (pref. 10s.)	1/6	1/—	1/6	1921–22	25
Oroville Dredging	4/—	3/9	3/9	Dec. 1923	3¾
Ouro Preto	2/9	2/6	2/9	May 1925	2½
St. John del Rey	10/3	9/7½	10/—	June 1925	6½
San Francisco Mines	29/3	28/7½	28/9	Sept. 1925	22½
Santa Gertrudis	20/3	19/3	20/3	July 1920	5
Selukwe (2s. 6d.)	12/6	12/—	12/—	April 1917	6¼
S. American Copper	5/3	4/9	5/—	Nov. 1917	75
Tanganyika	48/7½	45/7½	46/3	Jan. 7	1s.
Tomboy	4/3	4/—	4/—	Sept. 1925	5
Union Minière du Haut-Katanga (Brussels) 100 Fr.	.....	.....	6.875	July 1925	150(b)

* Free of British income tax. (b) Belgian francs. (c) Swiss francs.

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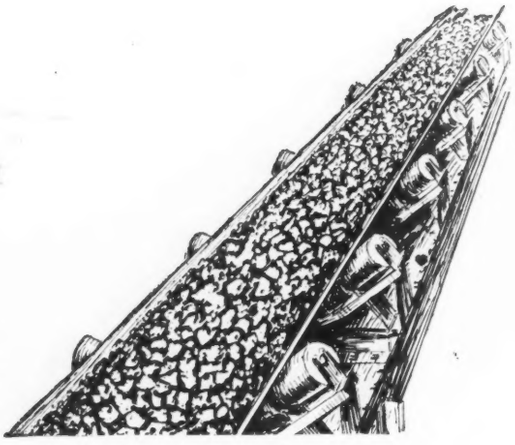

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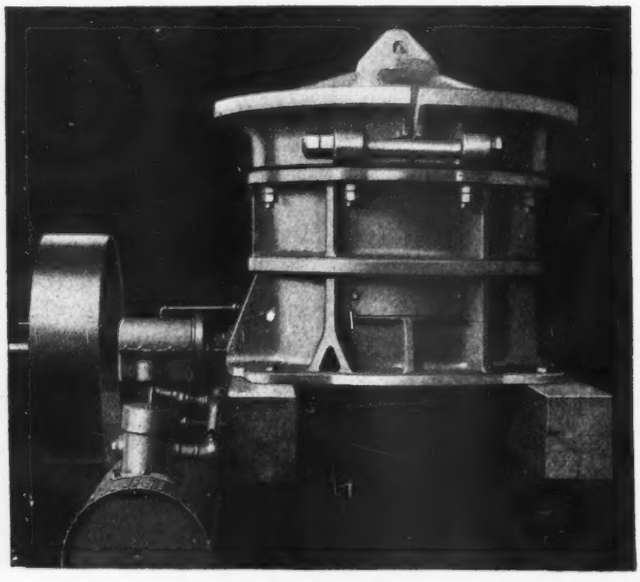

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The Metal-Mining Situation

By J. E. Spurr

THE YEAR 1925 witnessed activity in the mining industries, and a large amount of metal was produced in order to fill the demand caused by the large consumption in the industries in the United States and in Europe. The nonferrous metals, especially copper, lead, and zinc, have accordingly realized a fair degree of prosperity, and one in excess of the preceding year. The great demand for copper has been easily met, with no great price increase, the general level being around 14c. per pound as compared with around 13c. in 1924. The demand for lead also has raised the price to an average for the year of about 9c., as compared with nearer 8c. for 1924. This is over twice the pre-war level for lead, as compared with the price for copper, which is about the pre-war level. The reason for this is found in the relative abundance of the two metals, in the face of the increased post-war demand. Zinc also has increased in price with the accelerated demand, and averaged over 7½c. for the year, as compared with 6⅓c. for 1924.

THE IRON-ORE MARKET, on the other hand, has been and continues to be weak, due to an excess of productive capacity of the Lake Superior iron-ore mines over the consumption requirements. Heavy taxation of mines imposed by agrarian legislators, with not only the idea of income-producing, but with an almost punitive theory as well, has contributed to making the iron-ore industry less prosperous than the average industry, although 1925 has been somewhat better than 1924.

SWITCHING our attention from the commonest of metals—iron—to one of the most precious—gold—it is evident that this industry also remains at a disadvantage as compared with pre-war days. Economists who believe that the present high prices of commodities are due to a surplus of world gold cannot explain thus the steady higher price level as compared with the period just before the war, an increased level which must be the result of world inflation due to the war. Under these conditions gold costs more to produce, while it of course always sells at the same figure; and this difficulty will be slow to remedy. Platinum, which we think of in connection with gold, remains at practically the same price; but important new discoveries of the metal in South Africa may well presage a long-continued lowering of its price. Silver has advanced moderately. Since a large part of the silver production is in a way a byproduct of lead production, silver mining is less an independent industry than that of most metals. As to petroleum, there was an unexpectedly great production in 1925, due to the increasing output of Arkansas, creating a new high record for the United States and resulting in weakness for the petroleum market.

THE EXPECTATIONS of the metal-mining industries for 1926 depend upon the general prosperity of the United States and of Europe as well. As to that, it is well known that the general optimistic feeling as to both coincides with that recently voiced by Secretary Mellon. On the other hand, it is well to remember that the prosperity of the United States has no counterpart in Europe, even if Europe's condition is generally improving; and that if the present tendencies toward over-building, real estate and stock speculation should be pushed to the extremes that have marked the culmination of cycles of prosperity in the past, a cessation of the increase of the upward growth of mining and other industries might take place during 1926.

MINING INDUSTRIES, regardless of business cycles, are undergoing rapid evolution. The number of producing metal mines in the United States is continually shrinking, due to the exhaustion of smaller deposits; the actually increased production, in the case of most metals, being obtained from more intensive exploitation of the larger deposits which remain. Coincidentally, the process of combining these surviving producing mines into larger and larger financial and management groups goes on, this process recommending itself through greater control of production and marketing and by decreased overhead costs. Decreased costs have, moreover, been obtained through the substitution of machinery for labor, and through the substitution of better machinery for that formerly employed.

A NOTEWORTHY feature of mining also is that it tends to become international more than any other industry. As the mines in one country such as the United States are worked out, the capital hitherto employed in this country seeks mining investments anywhere else on earth. The British Empire and the United States continue to be the greatest of all mining nations; but formerly, while the British mining enterprises were world-wide, those of the United States were more markedly American and Mexican.

MINING IN 1925

Copper Approaches Normal Profit Margin

United States Produces 60 Per Cent of World's Requirements

By Arthur Notman
Mining Engineer and Geologist, 170 Broadway, New York

Arthur Notman

THE last year has been a profitable one for the copper industry. In 1924 the average cost of producing copper was fully 1½c. per pound lower than the pre-war average (1911 to 1915 inclusive), but, owing to the great excess of producing capacity in both mines and plant over current needs, the average price received for the metal was only 13c. and the profits were still below normal. During 1925, however, the average of *Engineering and Mining Journal-Press* quotations for the first eleven months was about 14c., the indications being that the balance of the year will at least maintain this figure. There is no reason to believe that costs will be any higher than in 1924. In fact, they may have been appreciably lower, and the additional cent a pound on price should nearly restore the pre-war margin of 3¾ to 4c. per pound in distributable earnings, although in commodity purchasing power this would be equivalant to only 2¼ to 2½ pre-war cents.

Technically, there was further improvement in copper mining and metallurgy in 1925. The substitution by some companies of caterpillar-tractor, mounted steam shovels for the railroad type, formerly used, resulted in important economies. Selective flotation made rapid strides in raising the grade of concentrates produced, thereby reducing transportation and smelting costs per unit of metal. An indirect effect of the improved recoveries and cleaner concentrates, made possible by oil flotation, has been to raise the iron content and materially reduce the excess of silica that burdened most of the copper smelters in the past. Some of them are now actually short of silica for economical operating.

It is not difficult to see signals in the domestic situation dictating caution in assuming that general business will continue at its present high level throughout 1926. On the other hand, the real improvement in Europe may fully compensate in the case of export commodities like copper for any slackening in domestic demand. With a production program based on intelligent study of general conditions throughout the world, there would appear to be no reason why the present price level should not at least be sustained and possibly improved somewhat during the current year.

It is too early to say how much improvement in costs was made during 1925, although the evidence available at this date is favorable. Perhaps the high-water mark of accomplishment for the industry up to 1925, viewed from every angle, was reached by the Utah Copper Co. in 1924, when it mined and treated 12,126,600 tons of ore carrying only 1.07 per cent copper, with small precious-metal values, and recovered therefrom 214,600,000 lb. of copper at a profit, after all credits and all charges, including depreciation but before depletion, of $8,185,392. It seems probable that even this record has been surpassed during 1925. It is important to realize the significance of such figures in extending the reserves of recoverable copper in the known districts of the world.

Since the purchase of the American Brass Co. by the Anaconda interests in 1922, there has been no further move in the direction of vertical integration in the industry, although horizontal integration has continued with increased acquisition of stock in Utah by Kennecott and the recently proposed consolidation of Nevada Consolidated with the Ray Consolidated, which already includes Chino. Such combinations should, in most cases, result in reduced overhead, more stable operations, and lower costs. On the other hand, to lessen the economic dangers of overproduction, perhaps no sounder policy could be adopted by the industry as a whole than that of combining the raw-material units with manufacturing units in a vertical integration, such as has taken place in the iron and steel industry in the last thirty years. Direct knowledge of consumers' needs possessed by such combinations is the safest guide to an intelligent production program, without which prosperity in the face of capacities largely in excess of current needs is elusive indeed.

With the close of the year we find additional evidence that persistent effort, coupled with improved price, has resulted in increased profit to the industry. With the resumption of dividends on Anaconda, Inspiration, and Nevada Consolidated and increases by Calumet & Arizona, Calumet & Hecla, Cerro De Pasco, Kennecott, Utah, and United Verde Extension over the 1924 rate, after allowing for duplications due to stock ownership, that part of the copper industry owned or controlled in the United States, which is contributing about 75 per cent of the world's total output, is distributing to its bond and stock holders, as bond interest and dividends, at the rate of $73,000,000 per annum, or approximately 3½c. per pound of output, as compared

Distribution of Copper Production

	1924 Per Cent	1925 (Ten Months) Per Cent
United States	54.1	60.0
Chile and Peru	16.4	14.6
Katanga	6.2	6.4
All Others	23.2	18.7
Totals	100.0	100.0

with $65,000,000 earned after depreciation and $55,000,000, or 2¾c. per pound, distributed in 1924. This rate is one-third higher than that of the preceding year and equivalent to 7½ per cent on the present market value of their outstanding securities.

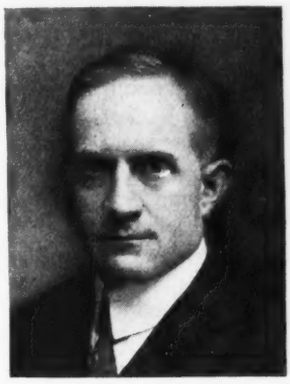
It is of interest to note the changes in the relative production of the important copper-producing countries shown in the accompanying table.

The prophets of the passing of the domestic copper industry can take small comfort from these facts, nor can foreign competitors rejoice greatly over the reduction in their measure of control from 29.5 to 25.1 per cent of the world's total. On the other hand, to reap the full benefits of our position, we should avoid the pitfalls of greed and produce what the world needs at a normal margin of profit, rather than all we are able.

Lead Mining Makes Highest Production

Total Output for 1925 Estimated to Be 634,000 Tons

By H. A. Guess
Vice-President, American Smelting & Refining Co., New York



H. A. Guess

LEAD-ORE mining for 1925, throughout the United States, Mexico, and Canada, showed continued prosperity and yielded for each country the highest lead production on record.

Pig-lead production for Mexico in 1925 was approximately 200,000 tons, representing an increase of about 14 per cent as compared with 1924. This increase was not due to the discovery of any new lead-producing districts, but represented increases in the tonnage of crude-ore shipments from producing mines and the starting up of numerous small shippers under the stimulus of high prices. Also, a considerable amount of the increase was due to the enlarged use of selective flotation for complex silver-lead-zinc ores.

In addition to enlargement in milling facilities at several plants, a number of new flotation mills were completed during 1925 for these complex ores, the more important ones being a mill of 600 tons' daily capacity for Compañia Minera Asarco at Parral and one of like capacity at Charcas. Also, one of the same capacity for El Potosi Mining Co. at Santa Eulalia, and a 300-ton mill for the Mexican Corporation at Fresnillo, Zacatecas. As these mills were completed at various dates throughout the year, their production will become more effective in 1926, and it is probable therefore, especially as several other mills are in construction or in contemplation, that there will be in 1926 a further increase in lead production from Mexico.

In Canada, the production is nearly all from one mine, the Sullivan, at Kimberley, B. C., and the work of enlarging its mining, milling, and power facilities, completed during 1924, had its full effect in 1925, resulting in an increase in lead production for Canada of approximately 40 per cent as compared with 1924. It is probable that a moderate increase over the 1925 production will represent the Canadian production for 1926.

In the United States the cost of major supplies showed little change from 1924. Wages averaged from 5 to 15 per cent higher in the four important lead-producing districts, and living costs were reported as ranging from practically the same as 1924 to 10 per cent higher. No labor disputes occurred throughout the year, and the miners shared in the general prosperity. There were no material changes in freight rates on ores or lead bullion in 1925. Pig-lead production in the United States was approximately 9 per cent higher than in 1924. The four major districts, stated in the order of their production, are: Southeast Missouri, Utah-Colorado, Cœur d'Alene, and Tri-State.

Southeast Missouri set a new production record at about 210,000 tons of lead in concentrates, as compared with approximately 200,000 tons in 1924, the production being almost entirely from the St. Joseph, National, and Desloge lead companies. In the Utah-Colorado district there were produced approximately 191,000 tons of pig lead from approximately 1,108,000 tons smelted. This is a substantial increase over 1924 and is due to the increasing application of selective flotation to the complex silver-lead-zinc ores of that region, and the high price of zinc concentrates throughout the year further stimulated the production from these complex ores.

The International mill at Tooele increased its capacity during the year from 800 tons to approximately 1,200 tons per day. The U. S. S. R. & M. C. is building a new flotation mill at its Midvale Plant, of some 800 tons' daily capacity, which will be in operation early in 1926. The Colorado Zinc Lead Co., at Leadville, is building a flotation mill of 200 to 300 tons' daily capacity for complex ores, which will be in operation early in 1926. Sunnyside mine, at Silverton, is contemplating increasing its milling capacity from around 700 tons daily to 1,000 tons, early in 1926. The expectation is, therefore, that in 1926 the lead production for Utah-Colorado will be largely increased over even the record figures of 1925.

In the Cœur d'Alene district, with the Hercules production suspended and Tamarack output curtailed, the production in 1925 was approximately 128,000 tons of lead in concentrates, compared with approximately 118,000 tons in 1924. Great improvement in selective flotation, particularly at the Morning mill of the Federal M. & S. Co., contributed to this increased production, resulting also in a higher grade of lead

concentrates as well as of zinc concentrates from the mill. Added assurance of a continuance of this scale of production for some time to come is given by the favorable developments at depth in the district during the year, the Hecla Mining Co. having opened up its orebody, with good width and values, on the 2,800 level and the Morning mine having had equally good results on its 2,650 level.

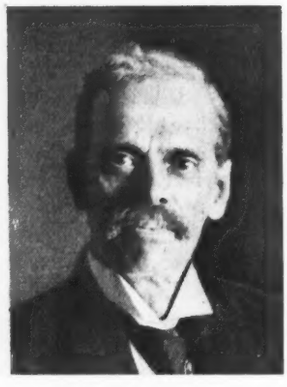
In the Tri-State district the production for the year is approximately 105,000 tons, compared with 94,000 in 1924. The flotation process, which had been slow of application in this district, because of the ease with which gravity processes separated the products, was extensively applied to slimes and contributed largely to the increase in the lead production for the year.

It is probable that new mines in the Tri-State district will be opened up of sufficient production to replace the mines that may become worked out during 1926, so that the production there for this year will equal or possibly somewhat exceed the production for 1925.

Zinc-Ore Mining Smashes Records

Year Closes with Low Stocks and Good Conditions

By Arthur Thacher
Consulting Engineer, Security Building, St. Louis, Mo.



Arthur Thacher

ZINC MINING has just closed a successful year. Not only has production shown a satisfactory increase, but consumption has more than kept pace, and at the close of the year stocks of both metal and ore were lower than they have been for some years. Prices advanced to the highest figures since the war and were materially higher than pre-war figures.

The Tri-State district continued to supply about two-thirds of the ore from which zinc is produced. In 1924 the district made a record production, but 1925 exceeded this in both quantity and price. Some doubt has been expressed about the life of the district, but operations in 1925 go far to allay this feeling. If the fears expressed three years ago were to be borne out, it would be natural, in view of the 1924 and 1925 production, to expect some diminution. On the contrary, there is increased activity—increased drilling, new mills going up, and new companies entering the field. At the close of 1925, 170 mills were reported in operation, with others nearing completion. A marked change is taking place in that a number of strong companies, with ample capital, entered the field and are operating groups of mines instead of a single mine, as in the case of individual operators.

Better prices and increased activity naturally resulted in increased output. Lower operating costs and rising metal prices have made available lower-grade ores, and this will greatly increase the ore supply. Another hopeful sign is the extension of the mining area through the development of the lower-grade parts of the district, and this is especially noticeable in the resumption of mining in Missouri. The Wisconsin district has shown a satisfactory percentage increase, and this will continue, but it is still too small to affect the totals. In the West about the only operation of importance is Anaconda, which has increased its electrolytic plant at Great Falls and is a large factor in the high-grade zinc supply. Most of the ore is purchased, but a large supply of its own ore is available, and the increase in the capacity of the smelting plant indicates confidence in the future ore supply. The New Jersey Zinc Co. continued production from its Franklin furnace mine throughout 1925.

The four districts noted produce most of the ore supply, the remainder coming from a few scattered mines which yield small tonnages. In addition, there is quite a quantity of zinc ore mined for oxide purposes, but this is generally low-grade ore unsuitable for making metal.

Most of the domestic zinc is used for home consumption, and the demand has been exceptionally great, breaking all records—even the high war figures. Exports have increased and have been exceeded only in the high war years. Zinc was not exported before the war.

A new feature developed in 1925 is the exportation of zinc ore. This was derived from the Tri-State district and also from the Far West from localities which could get the ocean freights. It is too soon to appraise the future of the ore exportation business. The sulphur in the ore has a value in Europe, and consequently the ore is not charged with freight on waste. Relative cost of smelting, recoveries, and the value of the sulphur are important factors in the economics of ore exportation. Whether the ore is smelted in Europe or the United States does not affect the world supply of zinc; the question involved is whether the smelting profits go to our smelters or the European.

An interesting event late in 1925 was the acquisition of the Silesian mines by the Anaconda company. It is to be expected that with capital and more vigorous operation, the Anaconda company will be able to greatly increase the output, but it is not likely that such increase will more than help to take care of the growing demand. American engineers are also developing some of the old European zinc, lead, and copper mines. With

capital and modern operation, an increased production in Europe will no doubt result. The world demand has, however, reached such large figures and yearly increases that the European supply is not likely to increase fast enough to affect conditions.

At the close of 1925, the spread between metal price and cost of the metal in the ore was greater than at any time since the close of the war, thus placing the smelters in a more favorable position. A better feeling exists between the miner and the smelter—an advantage to the industry. The best conditions prevailed in the latter part of 1925. The new year started with very low stocks and generally good conditions, and we can look forward to even a better year for 1926.

Gold and Silver Mining Shows Few Changes

Modern Monetary Practices Increase Gold Miner's Difficulties

By Sidney J. Jennings
Consulting Mining Engineer, 120 Broadway, New York

Sidney J. Jennings

ONE of the interesting results of the study of production statistics of gold is the fact that the equivalent of almost the entire production, during the years 1913 to 1924 inclusive, has been made available as a monetary basis. No such increase in the monetary stock of the world has heretofore taken place in a like time period. According to the report of the Director of the Mint, the production of gold throughout the world for the years 1913 to 1924, inclusive, amounted to $4,723,078,189. The accompanying table shows, in millions of dollars, the monetary stock of gold throughout the world in 1913 and in 1924, and the percentage of increase that the later year shows over the former.

World's Monetary Gold Stocks

In millions of dollars—last six ciphers (000,000) omitted

	1913	1924	Per Cent of Increase
Europe	$2,796	$3,278	17
United States	1,908	4,547	138
Other countries	589	1,844	213
Totals	$5,293	$9,669	82

If the total world production of gold during these years had been made available for monetary uses, the amount at the end of 1924 would have been $10,016,000,000. In other words, the balance, some $347,000,000 worth of gold produced during these twelve years, was hoarded or consumed in the arts.

These figures indicate a growing menace to the prosperity of the gold miner. They show the ability of the Federal Reserve Board of the United States and the Central Banks of Issue of Europe and other countries to accumulate gold on which a vast and increasing circulating medium can be founded. As this circulating medium is increased, prices of commodities and labor will increase, and the value of gold as a commodity will decrease and the expense of mining it will increase.

The benefit of these forces will be manifest to those nations which have large debts to pay and a corresponding loss will be incurred by those nations which are to receive payment. The direction of these forces and their possible extent were pointed out during 1925 by various economists. To the gold miner it looks as if the controllers of the monetary stock of the world were providing the world, at his expense, with a soft landing place from its period of inflation. He thinks that more consideration should be given him in other directions and that instead of heaping burdens upon the gold industry, its burdens should be lightened.

Gold mining in South Africa proceeded satisfactorily in 1925. Its leaders have pointed out the serious position of the low-grade mines on the Rand, if the continued demands of the labor union are granted and the government continues its exacting attitude toward the industry. There was shortage of native labor throughout the year under review, which was partly compensated by the increased use of jackhammer air drills. The production of gold in South Africa during 1925 was $211,073,754, which was 54 per cent of world production. During 1926 the production will be increased by an amount at least as large as the increase of 1924 over that of 1923.

Production of gold in the United States during 1925 will not show much variation from the amount produced during 1923 and 1924, years when production amounted to $50,160,103 and $50,570,294, respectively. Alaska is the only promising part of the United States from which an increase in production of gold can be expected.

Canada continues to increase her gold production, which was $31,532,403 in 1924, an increase of $6,238,325 over that of 1923. The increase for 1925 will probably be as much. Although the gold production in Ontario will continue to increase for some time, a decrease in the production from the Yukon will take place in 1926 and such a continued rapid increase in Canadian output as has taken place in the past is not to be looked for. Canada, however, still holds out great promise for an increasing output.

During 1925 the Russian Soviet Government returned the Lena Gold Fields to their former owners. The fields have possibilities, and if capitalists can be inspired with sufficient confidence in the Soviet government, some of the possibilities may be developed during 1926.

The slow decline of production in Australia and India continues. Mexico will probably show about the same

gold production in 1925 as for the last two years, or about $16,300,000. The total production for 1925 will probably record a small increase over that of 1924. There has been a decline of about four million ounces in the first ten months of 1925 in the output of silver in Mexico, the United States, and Canada. This has been partly offset by an increase of two million ounces in the output for Peru. These four countries produced 81 per cent of the world's silver during 1923 and 1924, and it is therefore probable that the production of 1925 will show a small decline over that for 1924, which totaled 239,068,295 ounces.

Friends of Mexico interested in silver production in that country are much disturbed by the proposed labor laws and the laws regulating foreign property ownership. Even though the extreme proposals are not passed by the legislature, capitalists have been frightened by the suggestions made, and the flow of capital into Mexico has been checked, which will slow up development of the silver-producing resources of the country.

In the United States, selective flotation of zinc-lead-silver ores has increased, and an increased amount of silver can be looked for from this source, which will tend to make up for the decline in production from straight silver ores. The new Pittman bill directing the Treasury to carry out the intent of the original act and purchase 14,589,730 oz. of silver at $1 per ounce from the mines of the United States has been reintroduced into the present Congress. It is hoped that this Congress will see that no breach in the good faith with which the original Pittman Act was passed will be made by a government department merely because in its judgment it is expedient to do so.

Only 120,421,338 oz. of fine silver was reported to the Director of the Mint as having been coined throughout the world during 1924, as compared with 232,998,544 oz. so reported in 1923. In spite of this fact the average price for silver at New York for the first eleven months of 1925 was 69.08c., as compared with an average price of 66.78c. per ounce for the year 1924. This would indicate that a large amount of silver is being hoarded or consumed in the arts.

Lake Superior Iron-Ore Mining Improved

Greater Tonnage Predicted for the 1926 Output

By Dwight E. Woodbridge
Consulting Engineer, Sellwood Building, Duluth, Minn.

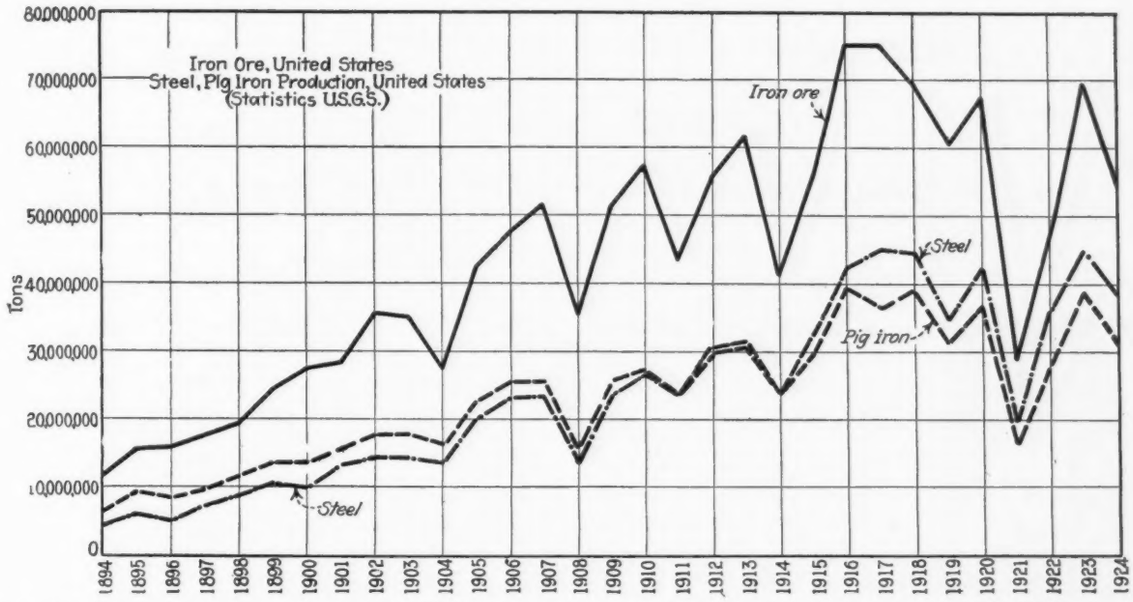
Dwight E. Woodbridge

IT IS ONLY by remarkable advances in technic that the Lake iron-ore region has been able to neutralize its accelerating disadvantages of cost. Mesabi nonbessemer ore sold in 1925 at $4.25 a ton at Lake Erie; indeed, sales of large quantities of ore were made at $3.75, for basic grade. This means that, after freights, royalties, and taxes were paid, there was left a sum perhaps approximating an average of 75c. to $1.25 a ton to cover all other items—mining, amortization of first cost and development, interest on unabsorbed advanced royalties, and profits. The matter of "interest on unabsorbed advanced royalties" sounds inconsequential, but so vast are the operations in the iron-ore business that, in the case of at least one large producer, it added more than 7c. to the cost of every ton shipped in the year, and that at a 6 per cent interest rate. What the profit item averages, after deducting other charges, anyone can guess. However, it looks a little better for the ore miner in 1926. Prices are expected to advance, and the guesses are anywhere from 25c. up to 75c. a ton. Perhaps 50c. is what will result. Costs will not change much, except for an expected rise of perhaps 10c. per ton in Lake freights.

Advances in technic are the constant study of those in the industry. Unlimited credit is due to them for maintaining the Lake district in its pre-eminent position. In 1925, there was no pronounced change, merely the continuation of the trend so notable in 1924, toward larger units and more complete mechanical operation. Tonnages grow, but the number of men employed does not, either at mines, on railways, or in the shipping department. Mining towns of the district have probably passed their crest of population; their period of building and development is over; the future shows only the steady pressure for tonnage, with machines more and more replacing men.

It is a common remark that there is an "oversupply of ore." The statement is superficial. There is an oversupply of minimum output requirements in leases whose unexpired term is too short to permit exhaustion of the mines except by forced production. No one expects that leases can be renewed at former royalty rates; therefore, some operators, in an effort to lighten ship, jettison less desirable properties and crowd their old leases which were made at a time when prices were low. Orebodies held in fee are idle, less than 1 per cent of ore now mined in Minnesota being royalty-free.

Oversupply of minimums will right itself before long, but there is suffering during the adjustment period. A number of mines, undesirable on account of grade of ore, cost of mining, or royalties, were dropped in 1925—concentration of effort on old leases will soon relieve that strain. The trend toward consolidation of mines in the hands of ore consumers, which was a notable factor in 1925, while it reduces the independent market, adds not at all to tonnage in sight, and ore consumption grows. It will not be surprising if Lake production of ore, which in the year just passed was



Iron ore, pig iron and steel production in United states—1925 iron ore production was 62,079,000 gross tons

approximately 55,205,000 tons, Lake and rail combined, approaches 60,000,000 tons in 1926.

Furnace operators are more insistent on uniformity of raw materials. By testing, grading, mining, sampling, and mixing its ores at the mines, the Steel Corporation secures as near uniformity as diverse types of natural ores are capable of giving. Some other producers approach as near the same condition as their conditions allow. But the process of mixing natural ores is an intricate one and cannot be exact. It cannot have much to do with sizing. It can be approximated only when the shipper has many mines and a tremendous consumption. Recent results from the use of sintered ores indicate a solution of the uniformity problem. One hundred per cent sintered ore in the furnace burden is quite new. A careful run in an Eastern furnace in 1925 proved that, at that plant at least, the use of a sintered magnetite increased the output of iron by more than 60 per cent and reduced the coke per ton by more than 40 per cent. Coke had been used in excessive amount in this furnace, and a fairer proportion of coke saving perhaps would be 15 per cent. Results at other Eastern furnaces were somewhat similar. There can be no doubt that, in the future, sintered ores will be in great demand, if these early results are confirmed and extended. It is probable that among forthcoming mechanical improvements at mines will be sintering equipment, not alone for those ores that must be so treated to become merchantable, but also for those ores that are physically capable of being made into a sinter. Indeed, plants for this work may become as common in Minnesota as washeries are now, not necessarily for treating concentrates, but for any fine-mesh, wet, or dusty ores. One such plant was put into operation in 1925 on the Cuyuna Range. It is the forerunner of others.

There are now forty-five plants in the Lake region for beneficiating ores by washing, jigging, crushing, screening, magnetic separation, or by sintering. About 20 per cent of the shipments of the region are products of these plants. Notable mechanical installations in 1925 were for ore treatment, chiefly for crushing and screening.

Water shipments for the year were 54,081,297 gross tons and all-rail shipments will be close to 1,125,000 tons, a total of 55,205,000 tons. Important shippers are given in the accompanying table.

Chief Iron-Ore Shippers in 1925

	Tons	Per Cent		Tons	Per Cent
U. S. Steel Corp.....	24,623,000	44.6	Shenango Furnace Company.....	808,000	1.5
Pickands, Mather & Co.....	9,930,000	18.0	C. K. Quinn & Co...	686,000	1.3
M. A. Hanna & Co..	3,691,000	6.7	Inland Steel Co.....	497,000	0.9
Cleveland-Cliffs Iron Co.....	3,403,000	6.1	Munroe Iron Co.....	478,000	0.9
Jones & Laughlin...	2,152,000	3.9	Marquette Ore Co..	328,000	0.6
Oglebay, Norton & Company.....	2,092,000	3.8	Stanley Mining Co.	277,000	0.5
Butler Bros.....	1,209,000	2.2	Ford Motor Co.....	273,000	0.5
McKinney Steel Co.	1,117,000	2.0	Maitland Mining Co.	258,000	0.4
			Davidson Ore Mining Co.....	852,000	0.4

Estimated Petroleum Production, 760,000,000 Barrels

Oil Industry Enters Era of Equalized Supply and Demand

By David M. Folsom
General Petroleum Corporation, San Francisco

COMMERCIAL production of petroleum for its present use as a source of heating, lighting, and power first occurred in the United States less than three generations ago, a production of 2,000 bbl. of oil being made from a single well in 1859. From that time to the present, the recorded production of crude oil has marked an irregular line, with sharp fluctuations which climbed on a steep gradient to 714,000,000 bbl. in 1924 and an estimated volume of 760,000,000 bbl. in 1925 from a total of 310,000 producing wells.

The changes in demand and the requirements for petroleum have resulted in the crystallization of the oil industry into definite periods. The first may be termed the "kerosene epoch." In the second epoch, the development of electricity as a more efficient means of lighting displaced the domestic use of kerosene. At the same time, the perfection of the internal-combustion engine, and its general adoption as a means of locomotion, created a rapidly growing demand for the lighter products of petroleum. Simultaneously, the increased use of the heavier products, classed under the general term of residuum and used as fuel to be burned under boilers for railroads, steamships, and factories, or used as gas oil in the manufacture of artificial gas, imposed upon the industry an obligation to supply a greatly increased quantity of crude oil.

The extent to which petroleum has entered the industrial life of this country is illustrated by the fact that the per-capita consumption in 1925 was approximately six barrels, as compared with one-fifth of a barrel per capita for the remainder of the population of the entire world.

The year 1925 was notable for the fact that production was maintained at a fairly uniform rate, and the total volume of this production made a new record for the country. As in previous years, this quantity would have been insufficient to meet the domestic requirements and the export trade if it had not been for the importation of crude from foreign sources of supply. The imports into this country in 1925 were approximately 77,000,000 bbl., while the exports of petroleum products were over 110,000,000 bbl. In 1925 the increasing demand for crude petroleum was met in three ways: first as in previous years, through the discovery of new fields; second, through the development of deeper sands as a result of improved methods of drilling; and, third, through the improvement in the methods of production.

The new fields which have been added during the year have not been as spectacular in their development as the pools discovered in the three preceding years, but the Big Lake district, in Texas; the Liberty pool, on the Gulf Coast; the Braman and Thomas pools, in Oklahoma; the Rainbow Bend, in Kansas, and the Inglewood field, in California, have been the important additions to the petroleum reserves of the United States. Developments in the Artesia and San Juan districts, in New Mexico, and the Fort Collins field, in Colorado, indicate new areas from which future supply may be secured.

Deeper sands in older fields have been discovered, and their content turned into production from the Smackover district, in Arkansas, and the Garber pool, in Oklahoma; and the fact that the limits on deep drilling have not as yet been reached is proved by the commercial production of oil in the Athens district, in California, from a depth of 7,500 ft. The output of old wells has been increased through improved methods in pumping and the use of gas under pressure and compressed air as a means to stimulate and revive the flow of old wells which formerly produced only through mechanical pumping.

The domestic consumption of gasoline in 1925 increased approximately 20 per cent over the 185,000,000 bbl. consumed in 1924, or a total of more than 220,000,000. This startling growth is due to the extension in the use of commercial vehicles. The use of motor trucks has grown to a point where this means of transportation for local freight and express has displaced the "short haul" on railroads and interurban lines; and the new bus lines have replaced street-car transportation in cities and interurban routes. This additional commercial use of gasoline has tended to smooth out the curve of consumption which formerly fluctuated with seasonal conditions. The extension and improvement of roads has also been a factor in this increased use.

To meet the greater demand for gasoline and lubricants, the use of the cracking process has been greatly extended until, in 1925, 70,000,000 bbl., or approximately 30 per cent of the total output in the United States, was obtained through this process. The further extension of it will tend to reduce the volume of fuel oil which will be available for industrial consumption. Apparently, the oil industry is entering a new era, where a reasonably steady supply will be assured and an equally steady demand will be supplied by improved methods of operation. Gasoline requirements can easily be reduced at least one-half through further improvements of the automobile engines, and co-operation between manufacturers and petroleum refiners has been established as a means to this end.

The range of prices of crude oil and petroleum products through 1925 can be gaged by the increase in

Mid-Continent crude of 35 deg. gravity from $1.10 per barrel on Jan. 1, 1925, to $1.35 per barrel on Jan. 22, and subsequent increases to $1.96 per barrel on July 10, 1925. This price was reduced on Aug. 28 to $1.71 per barrel and was maintained at this figure until the close of the year, although premiums above this price were freely offered.

The market price for gasoline throughout the year can be gaged by the New York tank wagon price, which started at 15c. per gallon; rose in four advances to an early peak of 21c. per gallon on Feb. 4, and then declined to 18c. per gallon on May 14. The year's peak of 22c. per gallon was reached June 13, but this price was not maintained and declined to 17c. per gallon on Aug. 26. This price was maintained practically constant throughout the remainder of the year.

Minor Industrial Metals

The Steel Alloy Group—Platinum—Quicksilver—Antimony—Arsenic—Bismuth—Radium, Uranium and Vanadium—Uncommon Ores and Metals—Aluminum

Manganese

By Charles Hardy

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THE outstanding feature in the manganese situation during 1925 was the agreement entered into between the Harriman interests and the Russian Soviet government for the exploitation of the Caucasian manganese fields. These deposits were, before the war, the principal producers of manganese ore in the world. Under American management there is little doubt that within a short time the Caucasus will again be the leading producer. The Harriman interests, according to report, include some of the largest users here as well as in Europe, and it is logical to assume that these users, interested in the success of the undertaking, will buy Caucasian manganese ore.

The market maintained during 1925 a firm position, with hardly any changes in prices. The importations into the United States during the year were at the approximate monthly average rate of 20,000 tons of manganese ore. This is about 5,000 tons less per month than during 1924. The importations of ferromanganese, however, increased from about 10,000 to 12,000 tons a month, and therefore, the smaller imports of manganese ore are compensated by the increase in the imports of ferromanganese.

Manganese prices have been, and probably will be, maintained not so much through any actual control of prices by the producing centers as by their comparatively small number, and the small number of consumers of ore. The production of manganese ore has been about equal to the consumption. The falling off of the production in the Caucasus since the war has been largely made up by heavy importations from Brazil. Now that the Caucasus are again starting to produce on a large scale, Brazil has practically ceased to be a large factor, and during 1925 made hardly any shipments. On the other hand, the Gold Coast is becoming a factor, and is reported to be able to produce it at a lower cost than any other manganese-producing country.

According to a recent statement, manganese ore production, owing to the developments on the Gold Coast and in the Caucasus, will be increased beyond the point of consumption, and, therefore, a heavy price reduction should be justified. I do not share this view, for the reason that development of new fields will require time. As a consequence, increase in the supply will be gradual and will be accompanied by an increase in consumption. Although a year ago it seemed almost impossible that the steel production of the United States would regain war-time figures, it is now generally expected that it will exceed those tonnages in 1925.

In one of my previous articles I stated that the world, owing to the war and economic conditions thereafter, is 200,000,000 tons short of steel supplies, which would have been used under normal conditions. This 200,000,000 tons, which will have to be replaced at some time, in addition to the normal business of the next few years, will assure a larger annual consumption of steel, which should take care of a sufficiently large tonnage of the increased production to safeguard the market from any violent fluctuations in the price for either manganese ore or ferromanganese during 1926.

Because of the ever-increasing demand for dry batteries, the consumption of which has enormously expanded through the development in the radio field, the demand for manganese dioxide has also increased. Whereas prior to the war this country relied almost entirely for its manganese dioxide supply upon imports, the material now produced in the West, principally from Montana, is finding its way into consumption on an ever-increasing scale. It is true that the percentage of manganese dioxide in this material is lower than in that of the imported material, but, though lower, the ore apparently is satisfactory for batteries. The duty of about $11 a ton acts as a handicap against the imported material. On the other hand, the Western manganese dioxide has to pay a high freight rate to consuming centers. The development by the Harriman interests of the Caucasian field will undoubtedly also bring about a reduction in the producing cost of manganese dioxide, which should increase the imports into the United States from that quarter to a figure more in keeping with the prewar importations.

Nickel

By Thomas W. Gibson

Deputy Minister of Mines, Toronto, Ont., Canada

PRODUCTION of the nickel mines of the Sudbury district in Ontario, Canada, rose, under the stimulus of war demand, from 22,960 tons in 1914 to 45,886 tons in 1918. The war over, output dropped in 1919 to 22,035 tons, rose to 30,615 tons in 1920, and fell to 9,128 tons in 1921 and to 8,678 tons in 1922. Absorption of surplus war stocks of nickel was slow, and the reduction in navy construction seemed to complete the disaster. The nickel companies met the situation by research, engineering skill, salesmanship, field service, and advertising. Probably $1,000,000 was expended in the campaign. The result was to demonstrate that nickel was as useful in the arts and industries as in war. Mining and smelting responded, and, in 1923, the output was 31,029 tons of nickel; in 1924, 36,638 tons, and for the first nine months of 1925 over 34,000 tons. The rate of production surpassed the prewar scale, and bids fair soon to equal the peak years of the war period.

The two producing companies at Sudbury are the International Nickel Co. and the Mond Nickel Co. The former refines its mattes at Port Colborne, on Lake Erie, and also exports a part of its product to Huntington, W. Va., for conversion mainly into monel metal. The Mond matte is shipped to Swansea, Wales, for refining at the company's Clydach plant. The copper contained in the International matte is recovered as metal, while the Mond method of treatment delivers the copper as sulphate of copper, which is largely used in viticulture in the Mediterranean countries. From the residues of the refining plants, important quantities of the precious and rare metals are recovered. The results for 1925 are for mattes refined in Ontario (nine months' produc-

tion) and Wales (six months' production) and are gold, 2,159 oz.; silver, 80,197 oz.; platinum, 4,414 oz.; palladium, 4,083 oz., and other platinum metals, 300 oz., the aggregate value being $968,977.

The mines worked chiefly are the Creighton and Frood by the International, and the Levack and Garson by the Mond. The latter is also developing the Frood Extension. A third company, the British America Corporation, went into liquidation in July, 1924. Its assets in Ontario, including the Murray mine, were purchased by the International company for $5,000,000.

Sudbury ore is being raised and smelted at the rate of one and one-quarter million tons per year, and the ore reserves are placed at 150,000,000 tons.

The New Caledonia nickel fields are exploited by two companies, Société le Nickel, and Société des Hauts-Fourneaux. The ores are of lateritic origin and contain no sulphur or copper, but like those of Sudbury they are smelted to a matte, and are afterward refined in France, Great Britain, and Germany. It is proposed to establish a refining plant at Yate, New Caledonia. Exports of matte to Aug. 31, 1925, were 2,872,175 kilos. This is practically on the same scale as in 1924.

Chromite

By Edward Sampson

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CHROMITE had a prosperous year in 1925. The total world production was probably close to the high record established in 1920, and at present the business can look forward to an increased demand. Imports into Europe appear to have been about as great in 1925 as in 1924, and imports into the United States seem to have increased nearly one-fourth, to a total of about 145,000 long tons.

Development of the Rhodesian mines has been remarkable. Rhodesia probably produces nearly seven-tenths of the world's supply. In recent years a high-grade "soft" ore has been increasingly used by the chemical industry, with the result that the New Caledonian ore, which formerly supplied this field, is no longer exported, the combined mining costs and freight rates, particularly the latter, being in favor of Rhodesian ore. The chromite deposits of Greece are still exploited by American refractory interests. Conditions in Baluchistan and Mysore appear to be unchanged. The Bethlehem Steel Co. imported nearly 30,000 tons from its mine in Cuba, which is more than three times the amount imported during 1924 and about 20 per cent of the total United States imports.

The principal change in the domestic market, besides general expansion, has been through the increased use of high-grade refractories by small, relatively low-temperature furnaces and even in fireboxes of steam-power plants. Chrome refractories are entering this field. High chromium iron continues to attract interest.

Tungsten

By Frank L. Hess

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THE rise in production of tungsten ores, the beginning of which was apparent when 374 short tons of concentrates, carrying 60 per cent tungstic acid (WO_3), was produced in 1924, continued through 1925, resulting in a production of about 1,050 tons. All was scheelite except the ferberite from Boulder County, Colo.

At Atolia, Calif., the Atolia Mining Co. mined only through lessees throughout 1925, as it has since it reopened its famous mine. At Bishop, Calif., the Tungsten Products Co. pushed its work actively. The ore is tactite (contact metamorphic material) of low grade, occurs at an altitude of 11,000 ft. in a country of heavy snows, and is reached over a difficult trail. It carries copper, which must be separated from the concentrates, so that careful operation is necessary if a profit is to be shown. Although politically in California, physically the deposit belongs to the Nevada group of tactite deposits. A small production was made in 1925 by the American Tungsten Co. from tactite in the Pilot Range, 23 miles southeast of Mina; by the Pacific Smelters & Metals Co., on the east side of the Nightingale Range, 50 miles northwest of Lovelock; and by C. W. Poole and the Nevada-Massachusetts Co., Inc., in the Eugene Mountains, a dozen miles north of Mina. C. W. Poole concentrated scheelite from the tailings of the St. Anthony Mining Co.'s mill at Toy, where tactite ore was worked during the Great War, and also produced scheelite from the Silver Dyke vein, near Mina.

In Boulder County, Colo., the Wolf Tongue Mining Co. made a small production of ferberite in 1925, and bought the output of other operators and of lessees. Altogether, the output amounted to an equivalent of only 173 tons of 60 per cent concentrates. Much of the output carried only 55 per cent tungstic acid (WO_3).

In Arizona the Hummel Wilson Tungsten Co. began operating a new 25-ton mill near Arivaca, on hübnerite, and a little scheelite and wolframite was produced by others. In the Black Hills of South Dakota, the Homestake Mining Co. made arrangements to begin mining wolframite again and prospectors took a lease on the old Wasp No. 2 property.

Considerable ore was held in stock at the beginning of the year, but by December less than 1,000 tons was visible on the domestic market. Imports to Nov. 1 amounted to 2,246,634 lb. of contained tungsten (of which about one-third was contained in ferro, mostly, if not all, from Germany), equivalent to about 2,360 tons of 60 per cent concentrates. Most of the ore was from China and most of the ferro was made from Chinese ore.

Prices in 1925 ranged rather regularly from $9 duty ($7.14) paid for good Chinese wolframite in January, to $12 in December. Scheelite was held at 50c. to $1 higher, powder or ferro at 90c. to $1.15 a pound for the contained tungsten in this country, and at 25c. to 35c. abroad, although British quotations nominally ranged from 24c. to 42c. for the contained tungsten in ferro.

*Published with the sanction of the Acting Director, U. S. Bureau of Mines.

Cobalt

By G. C. Bateman

IN 1925, as in 1924, the Deloro Smelting & Refining Co., of Deloro, Ontario, was the only smelter on this continent producing cobalt metal, oxides, and salts, although there were sales from the accumulated stocks of the Coniagas Reduction Co., of St. Catharines, Ontario, which ceased operating in 1924. It is understood that this supply has now been largely marketed. On account of the sales from accumulated stocks, and the supplies of raw materials stocked at the smelter, the figures giving the quantities marketed are not a trustworthy guide to mine production.

The Bureau of Mines for Ontario reports that for the first nine months of 1925 there were 560,777 lb. of metallic cobalt in the ore reported by the mines as having been purchased. The return for this was $184,063, or approximately 33c. a pound. During the same period the smelters marketed cobalt oxide, cobalt metal, and cobalt salts to the extent of 771,172 lb., having a total value of $1,614,000. This compared with 379,644 lb., having a value of $1,002,230, for the same period of 1924. The cobalt in mixed oxides, in residues exported, and in ores or concentrates exported amounted to 285,958 lb., valued at $206,761, compared with 481,049 lb., valued at $396,112, in the first nine months of 1924. This gives a total value of the cobalt products, exclusive of ore marketed in the first nine months of 1925, amounting to $1,820,761, compared with $1,398,343 in 1924.

The new developments in South Lorrain and Gowganda, together with the reopening of the old Agaunico mine, near Cobalt, which carries the highest-grade cobalt ore mined in Ontario, probably represents an increase in the available supplies, but the average price received by the producer, 33c. a pound, is about the same as in the preceding year. Nominal quotations for the metal are about $2.50 per pound, but it is understood that prices are less than this on contract.

Considerable uneasiness has been caused by the announcement that the Union Minière de Haut-Katanga would soon have supplies of metal, oxides, and salt on the New York market. It was expected that they would be available in the latter part of 1925, but they are not now expected until after the first few months of 1926. The Katanga interests have supplies of raw materials sufficient to enable them to control the world's market. They could, if desired, substantially reduce the price of the metal if it was felt that this would increase consumption sufficiently to compensate for the reduction. As a consequence, producers of ore are finding it more difficult to market their product,

as purchasers hesitate to commit themselves to contracts for future deliveries. The future is somewhat uncertain as to prices for both ore and metal, and will no doubt depend to a considerable extent on whether a marketing agreement is entered into between the Ontario and Belgian interests. The Belgian company's supplies are a by-product from its copper ores. It has a large cobalt refinery in Belgium.

Molybdenum

By John D. Cutter
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THE MINING of molybdenum in the United States, which was resumed during 1924 because of the depletion of war stocks, was continued throughout 1925. Operations, however, were on a minimum basis, because the demand for this metal, though showing a healthy increase, has not yet reached a point where it bears any appreciable relation to the available supply. Steadily falling prices prevailed throughout 1925.

The chief outlet for molybdenum is as a steel alloy, the use of which is practically confined to America, this country having progressed far beyond Europe in the application of molybdenum to the manufacture of the strong and tough steels demanded by the automotive and allied industries. With the market thus restricted, production in other countries was practically at a standstill.

The growing consumption of molybdenum by alloy steel makers in the United States has been greatly stimulated by the fact that molybdenum alone of the steel-alloying metals can be produced commercially in the United States to an extent which avoids all necessity for importation. Another factor has been the marked adaptability of molybdenum steels to large-scale production of automobile and other parts.

The most important development of 1925 was the practically total disappearance of ferromolybdenum from the market and the substitution of calcium molybdate as the furnace addition by the entire alloy steel industry. This process was begun during the latter part of 1924, and the change became complete early in 1925. Calcium molybdate is not only easier and less costly to produce, but it introduces the molybdenum into the steel bath in a much purer form, and steels made in this way are superior to those made with ferromolybdenum.

Platinum

By James M. Hill
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DOMESTIC production of crude placer platinum in 1925 was approximately the same as in 1924, when 335 troy ounces was won. Production of refined platinum metals of domestic origin in 1925 was apparently less than that of 1924, and it is doubtful if over 6,000 oz. was recovered by refiners of domestic ores and bullion.

Stocks of the chief platinum metals at the beginning of 1925 were: platinum, 40,464 oz.; palladium, 27,400 oz.; and iridium, 3,622 oz. Imports during the first nine months of 1925 were: platinum, 75,810 oz.; palladium, 5,405 oz.; and iridium, 1,866 oz., compared with the same period in 1924, when imports were: platinum, 67,096 oz.; palladium, 7,873 oz.; and iridium, 1,207 oz. England has been sending unmanufactured platinum to the United States at the rate of nearly 4,850 oz. a month, and imports of Colombia crude placer grains have been at an average rate of 2,660 oz. a month—somewhat below the average of 1924. Imports of osmium and osmiridium were nearly three times as large in 1925 as in 1924, reaching a total of 3,099 oz. for the first nine months of 1925. Rhodium and ruthenium imports were over twice as large, each being 3,023 oz. in the same period.

The domestic market for the platinum metals continued good throughout 1925, and opinion prevails that consumption equaled, and possibly exceeded, that of 1924. Platinum was quoted at $117 an ounce until April of the year under review, and during April and May gradually rose to $120 an ounce, at which figure it remained for the rest of the year. Crude platinum started 1925 at $111 an ounce, but in March reached $115, then declined to $114 in August, where it remained. Iridium opened the year at $225 an ounce, went to $375 early in April and to $400 in July, declining to $395 an ounce in October. Palladium was practically constant in price throughout 1925, quotations being $75 to $83 an ounce at the lowest and $80 to $83 at the highest period, in October. Osmium, which started the year at $100 to $104 an ounce, remained at that figure until July, then rose to $105 to $110, and again rose to $110 to $115 the first of November. Rhodium was constant at $85 to $90 an ounce throughout the year.

During 1925 the Russian Soviet government purchased five dredges from an American firm, and the first shipment on this contract was made late in October. These boats, destined for use in the Ural platinum fields, will hardly begin digging before late in 1926, if then. It is not thought possible that Russian production of platinum during 1925 exceeded 40,000 ounces.

In Colombia, the three boats of the South American Gold & Platinum Co. are now all electrically operated, and the power plant has a capacity for several additional boats, which will probably be built now that the Colombian Government has finally affirmed certain concessions of that company, which had been held up. The British Platinum & Gold Co. has rebuilt its dam on the Opogodo and increased the length of tailings stacker on the No. 2 dredge. During the first half of 1925 the company's output was greatly curtailed, averaging less than 100 oz. a month, but in September production had reached 412 oz. It is estimated that the output from Colombia was slightly less than in 1924, when about 45,000 oz. was produced.

South Africa's output of osmiridium byproduct from the Rand has increased considerably. The most important event in the platinum world is, however, the confirmation of the first reports of the extent and richness of the new platinum field at Lydenberg. With the Consolidated Gold Fields of South Africa actively developing its very considerable holdings, not to mention various other companies, it would seem beyond question that within a year South Africa will become an important producer of platinum. Much has yet to be done in working out the metallurgy of the South African dunite and pyroxenite orebodies, but there is little question that the solution will be reached soon.

It is reported that a new osmiridium field has been opened in Tasmania, and plans are being made to work a dunite body in the Warata district, in that country.

Quicksilver

By H. W. Gould
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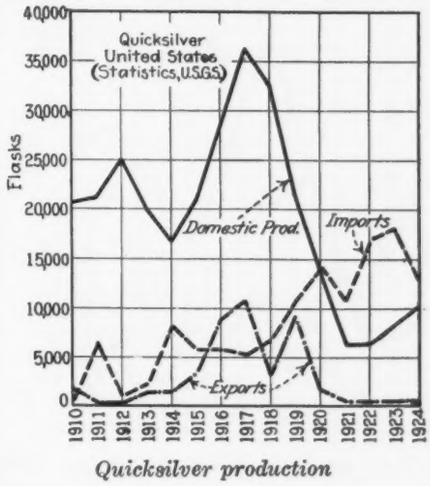
PRODUCTION of quicksilver in 1925 will probably show a decrease over that of 1924, in spite of gradually increasing prices and the best market condition since 1918. The price per flask has increased from about $70, New York, Jan. 1, 1925, to $92, as this is written, Dec. 1, 1925, with no spot metal of consequence in the country. Many who are in touch with the industry predict $100 per flask and upward during 1926, and this is probable.

Consumption of the metal in this country continues to increase, principally in the electrical and allied industries. Although accurate data are not available, the United States will probably consume nearly 45,000 flasks of mercury in 1926, or about one-half of



Quicksilver production

the world's production. This is nearly twice the pre-war consumption, and each year shows a heavy increase. European advices indicate an increased demand for the metal on the Continent, especially in Germany. For ten years prior to 1914, Germany was the world's largest market for quicksilver, and that country will probably again become a large consumer. Heavy importations into the United States continue from

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Spain and Italy, and a small amount is being received from Mexico. Very little quicksilver is exported, on account of the import duty of $18.75 per flask.

Though the European situation, as far as quicksilver production and marketing is concerned, is somewhat obscure, nevertheless it is apparent that the Spanish and Italian production is at present in very strong hands and that producers in Spain and Italy are in a position to secure the best possible prices for their product. Inasmuch as the bulk of the world's production comes from these two countries, and mostly from three or four mines, it is easy to understand how the market can be controlled. The following is a rough estimate that I have made of the world's 1925 production of quicksilver: Italy, 52,000 flasks; Spain, 32,000 flasks; United States, 9,500 flasks; Mexico and miscellaneous, 3,500 flasks; a total of 97,000 flasks.

In Italy, the Old Idria mine, at Carniola, that formerly belonged to the Austrian crown, is about worked out, according to London reports. However, the mines in the Monte Amita district are increasing production and probably will for some time. A new district, the Monte Labro, also reports a small output. In Spain the one producer, the Almaden, continues production at about the same rate as formerly, and it is hardly to be expected that this amount will be increased.

In the United States, as in 1924, most of the domestic production in 1925 came from four mines: The New Idria, New Almaden, and Cloverdale, in California, and the Chisos mine, in Texas. There was a scattered production from Arizona, Nevada, Oregon, and Washington. Considerable work is being done in California in reopening old mines and in new prospecting, and also in Oregon and Washington. Nevada reports considerable activity in the Mina district and near McDermott, on the extreme north boundary of the state. No new metallurgical development was reported for the year.

Arsenic

By Hamilton M. Brush

Vice-President American Smelting & Refining Co., New York

STOCKS of refined arsenic in the United States in the hands of the principal producers on Jan. 1, 1925, were approximately 6,700 tons. It is estimated that corresponding stocks on Jan. 1, 1926, were about 8,000 tons, and, further, that the stocks of calcium arsenate amounted on Jan. 1, 1926, to approximately 10,000 tons, or about the same as a year ago. This would indicate an increase in the stocks of refined white arsenic and arsenical contents of calcium during 1925 of approximately 1,300 tons only and a total consumption of about 20,000 tons of arsenic.

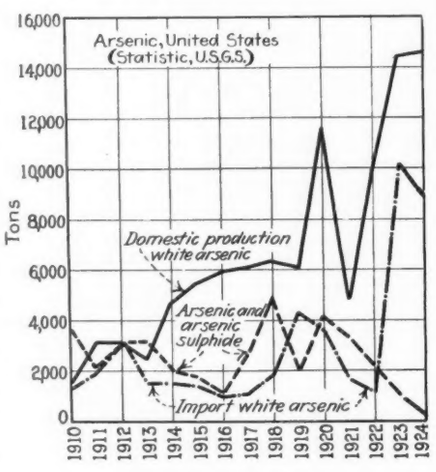
The foregoing figures are as exact as it is possible to get them with reference to refined arsenic in the hands of producers. Other figures are a mere trade guess, as no statistics are compiled showing stocks of arsenic, calcium arsenate, and other insecticides in the hands of manufacturers and distributors.

The figures in the accompanying table give a picture of the arsenic situation during 1925:

1925	United States Production Refined (*a*), Tons	Imports (*b*), Tons	Total Arsenic Available, Tons	Price per Pound (*c*), Cents
January	1,269	1,083	2,352	6.16
February	1,218	795	2,013	5.75
March	1,301	875	2,176	5.63
April	1,210	961	2,171	5.59
May	461	653	1,114	5.38
June	1,317	1,541	2,858	4.69
July	804	876	1,680	4.33
August	749	411	1,160	3.94
September	866	658	1,524	3.72
October	728	858	1,586	3.50
November	700 (*d*)	600 (*d*)	1,300	3.44
December	600 (*d*)	600 (*d*)	1,300	....
	11,223	9,911	21,234	

(*a*) American Bureau of Metal Statistics. (*b*) U. S. Department of Commerce Reports. (*c*) *Mining Journal-Press*. (*d*) Estimated.

The price, starting at over 6c. in January, showed a progressive decline for the entire year, until it reached the 3¼c. level, and there are rumors of even lower prices being accepted. Production in the United States was less than two-thirds that of 1924, but imports were slightly larger. Imports from Mexico recorded a substantial increase, whereas those from practically every other country showed a decrease. The principal countries from which arsenic is received in the order of their importance are Mexico, Japan, Canada, and Germany.



Arsenic production

Arsenic producers are now paying and have been paying for the last year the penalty which is inevitable when, as a result of special stimulation, the production of any article has been pushed beyond the world's consumptive requirements. Owing to the combined stimulus of a high price and almost panicky urging on the part of the United States Government and the Southern cotton planters, the country's capacity to produce arsenic was increased beyond reasonable consumptive demand, and there can be no doubt that plants are now available to produce arsenic to take care of any requirements which the trade can reasonably foresee.

At present prices arsenic is selling for less than the average cost of production. These prices must necessarily shut down any plants which are operating simply for the purpose of extracting arsenic from ores, thereby leaving the field to producers of byproduct arsenic. Production of arsenic as a byproduct through the widespread installation of Cottrell systems and baghouses is vastly greater than it was ten years ago, but it is questionable whether, with the increased use of arsenic for insecticides, this byproduct production will be sufficient to take care of the world's requirements. Time alone will tell, but it would certainly seem as though the pendulum had now swung too far. Despite a very light boll-weevil infestation, caused by most unusual weather conditions, domestic consumption of arsenic appears to have exceeded by more than 1,000 tons that of 1924, which in turn, with the single exception of 1923, broke all previous records.

Antimony

By H. K. Masters

Acting Secretary, New York Metal Exchange, 23 William St., New York

AN IMPROVED position of antimony from a price standpoint was conclusively demonstrated during 1925 by the higher price of the metal in all countries. Opening the year at substantially the closing price for 1923, 17½c., duty paid, New York, the price for prompt delivery was fairly steady during the first quarter, although future shipments from China were sold at considerably lower levels, one transaction in far-off positions being reported as low as 9c., c.i.f., equivalent to 11c., duty paid. Sellers, however, quickly reversed their position, and no sales were made during the year at below this figure, with spot metal recording a low of 11⅛c., duty paid, late in April. From this low figure the price quickly recovered to 16⅜c., duty paid, in May, futures remaining at a heavy discount.

The market feature during the first three quarters of the year was the heavy premium paid for prompt supplies, owing to almost complete exhaustion of stocks in both dealers' and consumers' hands. During the last quarter prices advanced steadily, closing very strong at 24½c. per lb., duty paid, for spot, with all future positions selling at 22¼c. to 22⅜c. per lb., c.i.f., New York. The duty is 2c. per lb. The new year opens at the same price levels.

Considerable tonnage has reached the United States from Europe, but high prices abroad now reflect very light stocks and difficulty of replacement from China, where prices even higher

than those in consuming markets are being asked. The immediate prospect is for maintenance of high prices.

Chinese production was large in 1925. Shipments from the interior for ten months averaged 1,283 tons of regulus, compared with a monthly average of only 932 tons in 1924 and 958 tons in 1923. Shipments of crude, or needle, were considerably heavier in 1925 than in 1924, and approximately equaled those of 1923. Oxide came forward in increased tonnage in 1924, though somewhat less than in 1923.

Certain interests are inclined to feel that, despite the heavy shipments from China, there is accumulation of supplies at the mines, but, so far, supply and demand seem fairly balanced at or near present price levels. The high prices have not yet had the effect of stimulating production in other countries, though one result has been the appearance of considerable high-grade domestic ore, and, for the year, this may amount to 1,000 tons of contained metal. Mexico does not seem to be doing much, and Bolivia has not greatly increased its ore shipments over those of 1924.

It is evident that the United States' consumption was unusually heavy in 1925, and the length of time the high prices will last is, naturally, dependent upon this factor, provided Chinese shipments are not increased.

Bismuth

By F. Y. Robertson

Vice-President and Manager Metal Sales, U. S. Smelting, Refining & Mining Co., Inc., 120 Broadway, New York

PRODUCTION of bismuth throughout the world in the latter part of 1924 had left considerable stocks in the hands of the manufacturers in England and on the Continent, with the result that in December of that year the price of bismuth was reduced to 5s. a pound, and this price was operative through January and February of 1925. In March the price was advanced to 7s. 6d., and in July to 10s., where it has since remained. The average price for bismuth during the years 1906 and 1907 was 5s., but at no period since that time until December, 1925, has the price touched so low a point.

The foreign syndicate fixes the price, based upon the amount of bismuth metal which it has in stock and in sight, and having agencies in various bismuth ore producing countries of the world it is able to keep in close touch with the bismuth situation; and wisely, when there is a surplus of metal on hand which cannot be marketed profitably, production is curtailed until the demand for bismuth increases.

China in the last few years has come into considerable prominence as a producer of high-bismuth ores, but, owing to the disturbed conditions of the country on account of civil wars, very little bismuth ore was mined or shipped in 1925.

The demand for bismuth in the United States has been fairly well maintained, and for the last six months of 1925 the price has held steadily at 10s. No new uses for bismuth have been found, but the steady increase in the use of cosmetics, face powders and other like products has undoubtedly helped to maintain the present standard price.

Russia has been recently a large buyer of bismuth metal and bismuth compounds, and the demand abroad seems quite active, so that it is reasonable to expect that prices will be maintained around the present level.

The production of bismuth in the United States for the year 1925 is approximately the same as in 1924, which was 300,000 lb. Though bismuth occurs in many of the ores in mines in the Western states, there have been no discoveries of regular deposits of ores carrying a high percentage of bismuth which promise any continuity, and Bolivia therefore continues to be the source of the largest contribution to the world's bismuth supply.

Bauxite and Aluminum

By James M. Hill

Engineer, U. S. Bureau of Mines, San Francisco*

DOMESTIC producers of bauxite further curtailed production in 1925, and it is estimated that the domestic output during that year was approximately 320,000 long tons, as compared with 347,570 tons in 1924. There was a decrease in output of bauxite in both the Eastern and Arkansas fields. Apparently no bauxite was mined in the relatively new Mississippi and east-central Alabama regions. Domestic bauxite was quoted at $5.50 to $8.75 a long ton throughout the year. French red bauxite, guaranteed 5 per cent silica, was quoted at $5 to $7 a metric ton until July, after which time no quotations were given for the French product. Adriatic bauxite for the first six months of 1925 was quoted at $4 to $6.50 a metric ton, but since July Dalmatian has been quoted at $5 to $6.50 and Istrian at $5.50 to $6.50 a metric ton. Dutch Guiana bauxite entered the market in July at $8.50 a long ton, New York, which quotation was maintained throughout the last half of the year.

Imports of bauxite for the first nine months of 1925 amounted to 281,905 long tons, approximately 31,300 tons a month, compared with 153,709 tons for the same period of 1924. Imports from British and Dutch Guiana were at the rate of about 22,500 tons a month, two-thirds from the British colony, shipped crushed and dried, and one-third from the Dutch colony, shipped crushed but not dried. Exports of bauxite concentrates, 58,496 long tons, during the first nine months of 1925 were 1,376 tons less than in the same period of 1924.

The domestic production of aluminum was somewhat hampered by severe drought conditions, and the Badin and Alcoa, Tenn., plants were forced to curtail operations for part of the late summer and early fall. Production of automobiles increased, and consumption by this industry, in spite of the prevailing high price of the metal, was still large. The use of aluminum paints for both interior and exterior work has grown with satisfactory performance. It is stated that railway-car and bus manufacturers are looking into the use of aluminum to reduce the weight of their products. The Aluminum Company of America has under way a large expansion of its Canadian manufacturing facilities and apparently contemplates the manufacture of alumina, as well as the metal, in that country. The use of the processes covered by the various Hoopes and Frary patents, issued in 1925, should make further expansion of the industry possible. These patents cover the process of refining high-silica aluminum into a commercial product.

Imports of crude aluminum during the first nine months of 1925 were 20,997,252 lb., a decrease of 1 per cent compared with the same period of 1924. Imports of plates, sheets, bars, and other products were only 81,732 lb. during the first nine months of 1925, a decrease of almost 90 per cent compared with the same period of 1924. Exports of crude aluminum (ingots, scrap, and alloys) during the first nine months of 1925 were 7,885,843 lb., an increase of 171 per cent compared with the same period in 1924. Exports of semi-manufactured aluminum also increased over 41 per cent, to a total of 6,498,546 lb. during the first nine months of 1925.

The quoted price of aluminum remained at 28c. a pound for 99 per cent and 27c. a pound for 98 per cent metal throughout the year until the first of November, when an advance of 1c. a pound was made in each grade.

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Radium, Uranium and Vanadium

By Frank L. Hess

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THE story of radium, uranium, and vanadium for 1925 is short. Katanga still overshadowed the radium market and produced so much radium, and so cheaply, that the factory of the Société générale métallurgique de Hoboken, Oolen, Belgium, at which the ore is reduced, is said to have been closed most of the year. In the United States only the United States Radium Co. operated, and that only a part of the year. Little mining was done, but W. J. Lewis and associates mined high-grade carnotite near Gateway, Colo., and some ore was mined by the Yellow Circle Mining Co., near Moab, Utah. The Czechoslovakian Government carried on operations at its radium plant at Jachymov (St. Joachimstahl) in spite of the stiff competition. In South Australia efforts are being made to produce radium from the deposits near Olary and Mount Painter, and some work is said to have been done in France on Madagascar ores and in England on Cornish ores. A little pitchblende was shipped from Portugal.

The price of radium in 1925 was nominally $75 per milligram, but sales were made at a somewhat lower price. Mesothorium, which is probably better

*Published with the sanction of the Acting Director, U. S. Bureau of Mines.

for the purpose, is still used in luminous paints in place of radium.

The Vanadium Corporation of America is still the largest factor in the Vanadium business, and continued operations in 1925 at its mine at Minaragra, Peru. The United States Vanadium Co. produced vanadium ore (roscoelite ?) from its deposit 12 miles north of Rifle, Colo., made fused oxide at Rifle, and from the oxide made ferrovanadium at its own plant at Columbiana, Ohio. The Pittsburgh Reduction Co. also isolated vanadium oxide at its Denver plant from ore mined on Yellow Cat Wash near Thompsons, Utah.

South Africa in 1925 continued to produce metallic vanadates, which were largely shipped to Europe, though a smaller part came to the United States. It had been expected that production of vanadinite would begin in Mexico, but none has been shipped up to the present from this quarter.

Prices for vanadium in 1925 ranged around $3.50 per lb. for the contained vanadium. Ore imports in the first nine months amounted to 2,177 tons, valued at $316,717. Most of the ore was from Peru, but 200 tons or more was from other sources.

It has usually been found unprofitable to make uranium salts in this country, but during the first nine months of 1925 13,548 lb. of "uranium oxide and salts" was imported, as well as 108 grains (about 7 grams) of racium salts, valued at $349,531.

Uncommon Ores and Metals

Cadmium—Cerium—Selenium—Tellurium—Thallium Titanium—Thorium—Zirconium

By H. C. Meyer

Vice-president, Foote Mineral Co., Philadelphia, Pa.

DEMAND for **Cadmium** during 1925 was normal. No important new uses for the metal were developed, and there was no marked fluctuation in price. The chief foreign source of cadmium is the Electrolytic Zinc Co. of Risdon, Tasmania. It is estimated that this plant is capable of producing in excess of the total output of the half dozen or more important American producers. As there is a duty of 15c. per pound on cadmium, it is safe to say that the domestic production is well protected, as the price of the Tasmanian metal has averaged around 50c. per pound. No definite figures are available on the 1925 production of cadmium in the United States, but it is probable that it did not exceed 130,000 lb. During the year the price remained practically stationary at 60c. per pound. A strong effort was made by German producers to sell the metal in this country at low "in-bond" prices, but the heavy duty prevented importation of any appreciable quantity.

The metal is offered to the trade in the form of sticks measuring about 10 in. in length and $\frac{7}{8}$ in. in diameter. It generally runs over 99 per cent pure. The chief uses are in the production of low-fusing alloys. Large quantities of the metal are used in the form of cyanide for cadmium plating by a patented process. Another important use for cadmium is as a sulphide. Statistics show that practically as much cadmium sulphide is produced as metal. It finds extensive use in the glass and pottery industries for the production of red, orange, and yellow shades. In the glass industry it is used in conjunction with selenium to produce beautiful shades of ruby and canary-colored glass. It is also used in the paint industry and on a smaller scale as an artist's color. Several shades of the sulphide are produced. The prices on this pigment ranged during the year from $1.10 to $1.20 per pound in lots of 500 to 1,000 lb.

Cerium—Demand for cerium during 1925 was on the same level as in 1924. Efforts were made to extend the use of the ferroalloy in the field of mechanical toys, but it is unlikely that any large commercial consumption was involved. Its most important use continues to be for gas lighters and pocket lighters, as well as in safety lamps and acetylene lights.

Some research work was done in 1925 in the use of commercial cerium, which is a mixture of cerium with small percentages of lanthanum and didymium. This work was along the lines of its application as a reducing agent for some of the rarer metals, as, for example, tantalum, columbium, and similar metals. It is a powerful reducing agent at fairly low temperatures. Its use has been advocated as a substitute for magnesium, but owing to its inflammable nature it is much more difficult to handle.

The price in 1925 ranged around $5 per pound for the imported product, and the ferroalloy was quoted in bond at around $4 per pound. Domestic ferrocerium, which appears on the market in the form of sticks measuring about 2½ to 3 mm. in diameter, sold for around $6 to $8 per pound, which is a somewhat lower price than that prevailing during 1924.

Practically all cerium produced is obtainable from the residues remaining after the treatment of monazite sand for its thorium content. Most of it is produced electrolytically from the anhydrous chloride of cerium. The ferroalloy is manufactured from the mixed metal by the addition of about 30 per cent of pure iron. It is cast into small sticks somewhat larger than a pencil lead. These are subsequently cut into small billets measuring about ¼ in. in length. Large quantities of the metal could be readily produced direct from monazite sand if a real commercial demand arose, and it is probably safe to say that the price could be reduced to meet that of magnesium, or around $1 per pound.

Selenium—There was apparently an overproduction of selenium during 1925, as large quantities of the domestic product were offered by foreign importers at prices considerably below those current in the United States. Most of this was apparently exported in the early summer and was shipped back to this country by the foreign buyers during the latter half of the year. No figures are available as to the value of this imported domestic selenium, but it is obvious that it was sold at a much lower price than is being paid by American consumers.

Production of selenium in the United States is confined practically to one concern, and hence no statistics are available as to the 1925 output. It probably did not exceed that of 1924, which was estimated at 130,000 lb. Siberian and Mexican sources of supply were dormant, although a small quantity was imported from Mexico. This is a red precipitated product of very high quality, and sold for slightly lower figures than the domestic product. There is no tariff on selenium. Prices during the first half of the year ranged from $2 to $2.10 per pound. During the latter half of the year the quotation dropped to $1.90 to $1.95 in lots of 500 to 1,000 lb.

Tellurium—During 1925 a new and it is to be hoped a real use for tellurium was developed by an English investigator. It was found that a colloidal solution of tellurium was exceptionally efficient as an insecticide, and that it was also an excellent germicide and preservative of wood. A United States patent has been allowed for the production of colloidal tellurium, and it is claimed that a pound of the element will produce approximately 500 gal. of concentrated product. Experiments are being made by one of the government bureaus to ascertain its value as a substitute for calcium arsenate for the destruction of the boll weevil. It is also thought to be of value in the treatment of wood subjected to the destructive action of marine barnacles. Its use has been suggested in tropical countries where all timbers are subject to destructive white ants.

Several years ago an organic compound of tellurium — namely, tetra ethyl telluride — was found to be of great value when added in small quantities to gasoline for motor fuel. It proved to be too expensive for this purpose, however, and lead was substituted. It also finds a limited use in the radio industry in connection with certain natural and artificial products as a crystal detector.

Commercial demand for the element during 1925 was insignificant, and several large lots were thrown on the market at distress prices. Large quantities were offered for as low as 60c. per pound. The nominal price, however, for the element in lump form, remained at around $1.75 to $2 per pound. Tellurium is marketed in the form of ingots or cakes, practically 99 per cent pure. It resembles crude antimony trisulphide in its physical appearance.

Thallium — Thallium is extracted from the flue dusts which accumulate from time to time in sulphuric acid plants, where pyrite is used as a source of sulphur dioxide. It is also found in the flue dusts from other smelting operations. Annual production is very

small. No doubt it could be greatly stimulated if a real commercial use were developed.

The metal is marketed in the form of sticks or small ingots. It resembles lead in physical properties. The United States and Germany seem to be the only commercial producers of thallium. A new use was developed during 1925 for thallium sulphate. Little is known as yet concerning its actual application, but it is rumored that it is used in the production of a powerful germicide. Other salts of thallium are used in the electric-lamp industry, in the production of optical glass, in photo-electric cells, and a small quantity is used for medicinal purposes.

No statistics are available as to the total world production during 1925. Prices remained practically stationary throughout the year and ranged from $6 to $8 per pound, depending on quantity.

Titanium—The most important commercial source of titanium at present is ilmenite, an iron titanium oxide, carrying from 30 to 50 per cent titanium dioxide. Practically all ferrotitanium, which is the most important titanium product produced in the United States, is manufactured from ilmenite. Ferrotitanium is consumed in large quantities as a scavenger or deoxidizer in the manufacture of open-hearth steel. Only two manufacturers in the United States produce the alloy, one making a carbon ferrotitanium and the other a carbon-free alloy.

Abundant supplies of ilmenite are found in eastern Canada in massive form, carrying from 30 to 35 per cent titanium dioxide. A large quantity is secured from the concentration of beach sands along the east coast of Florida, and the Virginia rutile deposits also produce limited quantities. The mineral is also marketed in the form of fine concentrates, which are produced during the electro-magnetic concentration of monazite sand in Brazil and India. The concentrates carry from 45 to 50 per cent titanium dioxide.

The other important source of titanium is rutile, the natural oxide, carrying from 90 to 95 per cent titanium dioxide. Large deposits are known to exist in various parts of the world, but there are only two localities which are worked on a commercial scale at present, those in Virginia and those near Risor, Norway. Large deposits are also known to exist in Australia and South Africa, but these have not been worked yet on a large scale.

Virginia rutile occurs disseminated in a peculiar rock, where it is associated with ilmenite and apatite. It is separated from these minerals by crushing and concentration. The mineral is of a dark reddish-brown shade and carries a high percentage of titanium dioxide.

Norwegian rutile occurs disseminated in a feldspathic rock, from which it is separated by crushing and mechanical concentration. It is a brilliant black and carries from 92 to 96 per cent titanium dioxide. It contains a small percentage of vanadium, to which the black color of the mineral is attributed.

The most important application of rutile is in the ceramic industry, where it is employed as a pigment to produce browns and yellows. It is the only oxide producing browns or yellows which will stand extremely high temperatures without bleaching or fading. A small quantity of specially prepared rutile is used in the manufacture of artificial teeth and is sold under the trade name of "Titanellow."

Prices on both ilmenite and rutile were normal throughout 1925. Ilmenite concentrates in carload lots ranged from $10 to $20 per ton. Canadian lump ilmenite was procurable at somewhat lower figures. Rutile ranged from 10 to 15c. per pound for both the American and Norwegian products. No statistics are available as to the exact production of either rutile or ilmenite during 1925.

Thorium — The consumption of thorium ore (monazite sand) during 1925 was even less than that of 1924. This is due to the rapidly waning demand for incandescent mantles, which required considerable quantities of thorium nitrate, produced from monazite sand. Practically the only country producing thorium nitrate at present is Germany. The German product sold druing the first half of the year at around $4 per kilogram, duty paid. During the last half the price ranged from $3.50 to $3.75 per kilo.

There are only two deposits of monazite sand in the world which have been worked on a commercial scale, those in Brazil and those in India. Brazilian monazite carries a minimum of 6 per cent thorium oxide. The Indian runs 8 per cent. Prices were purely nominal. Large lots of either sand could be purchased at around 6c., per pound. No tariff is imposed on monazite concentrates. There is an increasing demand for thorium in the manufacture of tungsten filaments for both incandescent lights and radio tubes. A small quantity of the metal, however, makes many thousand feet of filament. The annual consumption is insignificant.

Zirconium—A slight increase in the demand for zirconium ores is to be noted for 1925. The two commercial sources of zirconium are the natural oxide produced in Brazil, known under the trade name of "Zirkite," and the silicate or zircon, which is extracted from the beach sands on the east coast of Florida, and is obtained also as a byproduct in the electro-magnetic concentration of monazite sand in Brazil and India. Indian zircon is much purer that the Brazilian, being practically free from ilmenite and other foreign minerals.

The most important commercial use of zirkite is as a refractory. It is produced in standard firebrick shapes as well as in granular form, and is also procurable in ordinary calcined form, and an electrically sintered grade is marketed. The latter, however, is quite expensive. Production of zirkite bricks, crucibles, and other articles is attended with considerable difficulty, because of the lack of any natural plasticity.

During 1925 a new form of zirkite cement was placed on the market, known as plastic grade. This has proved to be an excellent patching cement. Through the use of a special organic binder a highly plastic mass is secured by the addition of water. Plastic zirkite cement sets at ordinary room temperatures to a hard mass. The binder does not impair its refractory properties.

A greater demand was noticed during 1925 for pure zirconium oxide. This is now marketed in large quantities and carries from 98 to 99 per cent zirconium oxide. It is one of the most refractory oxides known. It is also being used to a limited extent as a substitute for tin oxide in the enameled metalware industry under various trade names.

Standard 9-in. zirkite bricks sold at $1,000 per thousand during 1925. Zirkite cement, 80 per cent grade, commanded a price of $50 per ton in carload lots. Zirkite cement, plastic grade, sold at 6c. per pound in ton lots. The pure oxide, sold under the trade name of Zirkonalba No. 1, ranged in price from 56 to 75c. per pound, depending on quantity. The price of zirconium metal powder remained unchanged at $30 per pound. Ferrozirconium, zirconium ferrosilicon, and silicon zirconium remained firm, standard ferrozirconium selling at around $3.50 per pound.

Panorama of the Park-Utah Consolidated Mining Co., Park City, Utah, Showing Loading Station and Shops

Industrial Non-Metallic Minerals

Asbestos—Mica—Graphite—Talc—Silica Group—Clay Group—Barytes—Gypsum—Magnesite—Fluorspar—Fertilizer Group

Asbestos

By Norman R. Fisher
Consulting Engineer, Thetford Mines, Quebec, Canada

CONCOMITANT with the marked improvement in industrial conditions generally, particularly in Europe, the Canadian asbestos industry made a splendid recovery during 1925 from the disquieting conditions that obtained in it throughout 1924. Completed figures on operating results are not yet available, but what there are show that not only will 1925 prove to be the banner year in the matter of sales, but that the average price obtained, though still far below the record price in 1920, will nevertheless be 15 per cent or more higher than it was in 1924.

A comparison of the estimated sales for 1925 with those of the five years immediately preceding is given in the accompanying table.

Canadian Asbestos Production

Year	Amount Sold, Tons	Total Value	Average Value Per Ton
1920	179,891	$4,749,048	$81.99
1921	87,475	5,199,789	59.44
1922	160,339	6,053,068	37.75
1923	216,804	7,364,260	33.97
1924	208,762	6,561,659	31.37
1925	248,400 (a)	8,917,360	35.90

(a) Estimated.

The table indicates an estimated average price for 1925 of $35.90, but at the time of writing (December, 1925) the price was nearer $37 per ton, with promise, in the light of present and prospective market conditions, of its rising appreciably in the near future.

During 1924 the Canadian asbestos industry, after a long period of internecine strife induced by the total absence of co-operative action among its members, eventually arrived at a condition so chaotic, both commercially and financially, that it became essential to effect a remedy in some way. The situation was taken in hand by Dillon & Reed, of New York, under whose direction a canvass was made, and it was eventually decided to try to effect a combination of the various interests concerned. That the efforts of those directly engaged upon this work were crowned with success is now apparent from the recently announced merger that will embrace, to begin with, the following important companies: Asbestos Corporation of Canada, Ltd., Consolidated Asbestos, Ltd., Thetford-Vimy, Ltd. (lately Martin-Bennet Co.), Black Lake Asbestos & Chrome Co., Maple Leaf Co., Federal Asbestos, Ltd., and Asbestos Mines, Ltd. The parent company is known as the Asbestos Corporation, Ltd., and when the necessary transfers are completed it will control the future destiny of the present holdings of the companies mentioned. At its present stage the consolidation does not include all the actual or potential producers of the district, but it does embrace those most vital to its immediate success. The chief factors will be some measure of output regulation, centralized control, and economies generally throughout the business.

Of the asbestos consumed throughout the world during 1925 Canada supplied about 84 per cent. Practically all of the remainder was supplied from the mines of Rhodesia, the Union of South Africa, Russia, and Cyprus. In 1924 Rhodesia and South Africa together sold 33,374 tons of fibre, having an average value of about $103 per ton, but figures so far available for 1925 indicate that, although the sales for this year will be greater by about 5,000 tons, the average value will be about 10 per cent less.

Russia is now producing about half its pre-war output, or 10,000 tons per annum, and two-thirds of this, having an average value of about $100 per ton, is being exported to Central European consumers.

Cyprus asbestos production in 1925 will be about the same as in 1924, which was 4,337 tons, of an average value of about $80 per ton. It is reported that the annual future production will be about double this, owing to the installation of increased milling capacity during 1925.

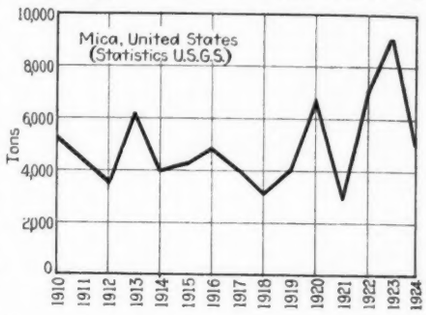
Only a small quantity of asbestos was produced in the United States during 1925, and this was from widely scattered points. One thousand tons should more than cover the whole output, which was made up of comparatively small quotas from California, Montana, Arizona, Georgia, Maryland, and Vermont. Anomalous as it may seem, the United States consumes more than 60 per cent of the world's present annual output, which is around 300,000 tons.

Mica

By J. A. Rogers
Treasurer, Standard Feldspar Co., Rumney Depot, N. H.

GOVERNMENT reports covering domestic mica production for 1924 disclose several interesting developments, the most outstanding of which is the fact that during that year New Hampshire established itself as leader of all mica producing states. It produced 51 per cent of the country's total output of sheet mica; North Carolina 40 per cent, and the remaining 9 per cent was produced by Virginia, Alabama, Colorado, Connecticut, Georgia, New Mexico, South Carolina, and South Dakota, all unimportant factors.

Practically the entire output of New Hampshire mica comes from Grafton County, where the mica industry started more than a century ago, and is produced by the Alexandria mine, owned by the General Electric Co., under the management of George W. McNaughton, and the Ruggles mine, now owned by the Standard Feldspar Co. During 1925 the two properties operated continuously, and there is little doubt that



Mica production

when government figures for the past year are available they will show that New Hampshire produced an even greater percentage of the country's total output of sheet mica than it did during 1923.

The mica outlook for the coming year is unusually favorable, and with the tremendous electric developments which are bound to be brought about during the [illegible] years, this essential mineral will become even more important. Anticipating this, preparations have been completed by the Standard Feldspar Co., for extensive operations. This company entered the field of mica and feldspar mining during the last two years.

Graphite

By Benjamin L. Miller
Professor of Geology, Lehigh University, Bethlehem, Pa.

NO important developments in the graphite industry occurred during 1925. Madagascar again dominated the situation in flake graphite and to such an extent that graphite production suffered in practically every other country in the world. In fact, it seems to be fairly well recognized that Madagascar can serve the world's demand for flake graphite, Ceylon can supply the crystalline lump variety favored by most graphite crucible manufacturers, and Mexico furnish the bulk of amorphous material used for lead pencils, leaving to the local demands of the different countries only the cheap amorphous grades utilized for foundry facings, paints and similar purposes. Ceylon and Mexico need fear no competition, as they possess unique deposits, whereas flake graphite is widespread in its occurrence, and the

only reason why Madagascar can control the world's markets is because of its low production cost. Here and there, individual companies favorably situated and well managed are able to continue operations, but most of the flake graphite plants of the pre-war and the war periods are now idle and with no probability of revival.

In the United States there was small production in 1925. Two companies were active in Alabama during part of the year; the Southwestern Graphite Co., of Texas, is reported to have been in operation for part of 1925; a company was organized to work a graphite deposit near Annandale, N. J.; and a small amount of amorphous graphite was produced in Rhode Island, as in former years. Two Canadian companies operated. The Black Donald Graphite Co., Ltd., was most active. The Graphite Refining Co., Ltd., of Port Elmsley, Ontario, had a small production. Three companies, all American, operated graphite mines in Sonora, Mexico, during 1925. All of the material came to the United States, where it was refined and then shipped to consumers in this country and Europe. The production for the year is estimated at about 8,000 tons, somewhat less than in 1924.

In Madagascar, the war accumulation having been exhausted, there was renewed activity during 1925. The shipments from the island are estimated at about 600 tons a month. The Ceylon industry was also more active than in former years. Italy and France produced several thousand tons of amorphous graphite, used on the Continent and in England for foundry facings.

With practically no graphite to be sold at sacrifice prices as in former years, the price of certain grades of graphite increased during 1925. New York prices for Ceylon material averaged about as follows: No. 1 lump, 9½ to 9¾c.; No. 2 lump, 8 to 8¼c.; No. 1 chip, 7½ to 8c.; No. 2 chip, 7 to 7¼c.; No. 1 dust, 5 to 6c.; No. 2 dust, 4 to 5c. per pound.

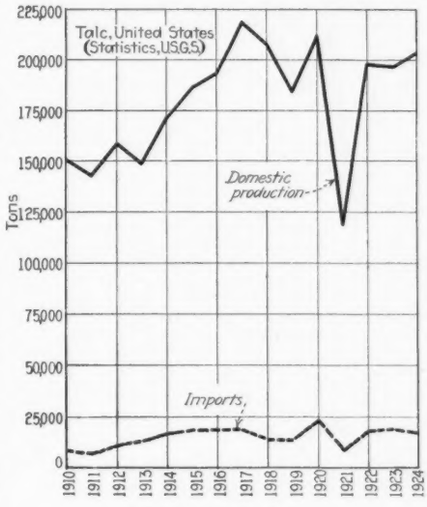
Flake graphite from Madagascar, after paying a duty of 1¼c. per lb., sold in New York at 6 to 8c. per lb. The Canadian and domestic flake graphites seem to have commanded approximately the same prices.

Talc

Editorial Summary

PRODUCTION in the talc-mining industry in 1925 probably exceeded that of 1924. The year was prosperous for the domestic producers, although imports increased appreciably over those in 1924. The present duty on talc, 25 per cent ad valorem, is insufficient to overcome foreign competition, but nevertheless the bulk of the demand is satisfied by domestic production, which centers in New York, Vermont, Virginia, California, Pennsylvania, and North Carolina. New York and Vermont are the important states, and California is the principal Western producing state. Producers in New York report a good year, with an increase over 1924, the increase being in paper-filler grades. Deeper development is under way at the mines near Gouverneur, N. Y.

Talc production in California in 1925 was made by five companies, of which two, one operating in Inyo County and the other in San Bernardino County, in



Talc production

the aggregate contributed 13,000 tons to the state's production, most of which went into toilet powders. The three other companies made an estimated production of 4,000 tons, which found its principal outlet in paint manufacturing, with some incidental use for paper. Practically all of the California talc sold in Eastern markets is shipped from Los Angeles via the Canal, but that which is sold to the Mid-West market goes to its destination by rail. Freight rates to Eastern markets have been the lowest so far received, but it is expected that an increase will be made in 1926.

Quality of various grades has been fully maintained up to past standards, which are comparable with foreign standards. A special grade which is used for water-proofing and strengthening concretes has been developed by the W. H. Loomis Talc Corporation, of Gouverneur, N. Y. New paper-stock grades contain a higher percentage of thin unbroken fiber than any other grade and have proved well adapted for the purpose.

Tripoli

By G. V. B. Levings
Resident Manager, American Tripoli Co., Seneca, Mo.

BUSINESS in tripoli mining during 1925 in its general trend was similar to that of 1922, a gradual recovery from a period of decreased demand. The summer dull period was less pronounced than usual, and the fall increase came in August, a month ahead of time, and has been particularly well sustained.

Deliveries amounted to 12,000 tons for 1925, about 1,000 tons better than 1924 and nearly the same as for 1923. The noticeable feature has been the steady improvement in foreign buying, especially in Europe, which is now about on a par with the best year's prior to 1914. This is proof of the general improvement in business conditions abroad.

No new uses of importance developed for tripoli during 1925, but the more general introduction of Duco, on which tripoli is used as the final rub, and the increasing use of tripoli as a filler in hard rubber and analogous compositions, broadened the demand. Prices remained stable throughout the year, and no marked change is anticipated in the near future.

Diatomite

By A. W. Allen
Assistant Editor
Chemical and Metallurgical Engineering

SUCCESS in a new field was the significant development in the diatomite industry in 1925, as indicated by the rapidly expanding use of the material as a conditioner in concrete. The addition of finely divided material has long been recognized as a means of insuring what is known as flowability; and it is now generally acknowledged that the inclusion of a small percentage of fine diatomite in the mix will give excellent results. For lack of data, a scientific explanation of the reaction in precise terms would be premature; but some evidence has been adduced to show that the diatomite, being a gel colloid soluble to some extent in alkali, may serve the dual purpose of (1) adding plasticity to the mass and (2) providing a small amount of silica in a form available for the production of additional bonding crystals.

Normal progress has occurred in the use of diatomite as an insulator, a filter aid, and for a multitude of other purposes. It is firmly established in the sugar-refining industry; and one may look for technical developments leading to its use in conjunction with a finely divided decolorizer, thereby combining two major plant operations in one. Research has shown that the filtering power of the material is due to the latticing of minute spicules; and photomicrographic evidence indicates that careful disintegration, to produce the maximum of such spicules, is an important factor in the processing of a high-efficiency filter aid.

It is not generally recognized that diatomite occurs in immense variety, and that many types are useless for some purposes. A careful selection of raw material for each specific use is necessary to insure efficient application.

Increased interest was shown during 1925 in the recovery of petroleum from impregnated diatomite in the Pacific Coast region, and plant extensions are under way which indicate that the industry will become a firmly established one if crude-oil prices permit. Promising results have been obtained in the manufacture, on a small scale, of heat-resisting brick from the spent "shale." Some work has also been done with a view to utilizing the waste product as a clarifying and decolorizing medium.

No developments of major importance in the exploitation of new deposits

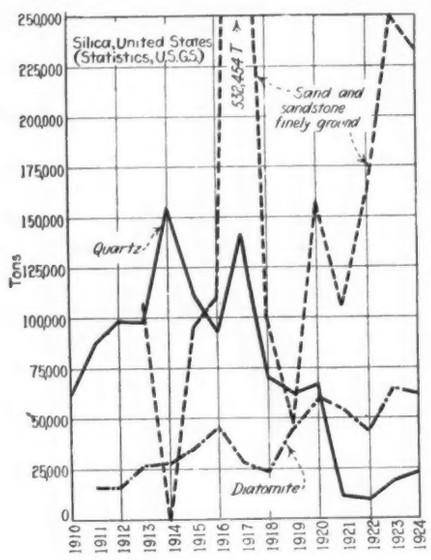
occurred in 1925; but increased activity and widening applications indicate a promising outlook for 1926.

Silica

By Hjalmar E. Skougor
Consulting Industrial Engineer,
120 Broadway, New York

INCREASE in demand for silica during 1925 was largely taken care of by extensions to existing plants rather than by new plant construction, consequently leaving little to report in new developments.

The last year advanced the art of air separation through the introduction of a dry grinding mill which operates in close circuit with a successful air-separating unit, the combination having been developed by one of the



Silica production

grinding-mill manufacturers. The complete unit promises to eliminate expensive and cumbersome wet-grinding methods and should be closely investigated by producers of finely ground silica.

The building program of the United States for the two last years has given artificial stone manufacture a tremendous impetus. According to the Department of Commerce, the value of artificial stone rose from $32,000,000 in 1923 to $53,600,000 in 1924. Ground silica and quartz are used to a great extent in this industry, largely, however, for the purpose of securing a pleasing texture rather than for strength. Other products required in the manufacture of artificial stone are stone, gravel, cinders, sand and cement.

Plant extensions worthy of mention have been made by the Feldspar Co. near Gloversville, N. Y., which has just completed a large extension to its property, the intention being to operate the new unit temporarily as a silica-grinding mill. This enterprise is producing ground feldspar and silica for the general trade, and a large plant near Lewiston, Pa., recently extended, produces white silica and light yellow silica for glass making and glass grinding for one glass plant.

The exhibition of articles made from fused quartz at the last Chemical Exhibition indicates the great and promising advance in this art. Given a year or two more, it is sure to assume a prominent place among important industries.

Feldspar

By Frank P. Knight
President, Mineral Products Co.,
Beverly Farms, Mass.

THE year 1925 closed with estimated sales of about 230,000 tons of feldspar from mills having a capacity to produce 410,000 tons. Four grinding plants were built, which added 60,000 tons to producing capacity. Notwithstanding this condition, rumors are heard of intention to build more grinding plants. A note of warning should be sounded. Experience has shown that a dependable ground feldspar can be produced only by a company having adequate capital, suitable mechanical equipment, large developed reserves of crude feldspar, and, what is perhaps more important, an organization that has had long experience in the several branches. Competition will very likely increase during 1926 because of the desire of each of the grinders to operate his mills to capacity.

The tendency toward lower prices for finished material continued until near the close of 1925, when prices became somewhat stabilized at a level which seems too low to be healthy. North Carolina remains the banner producing state, with a probable total production of 100,000 tons of crude. It should be noted that this state alone produces more than three times the indicated production of Canada. During 1925 a consolidation of two of the larger producers was announced. It is estimated that this company now controls approximately 30 per cent of the grinding capacity of the United States.

Consumers and producers have shown increasing interest in each other's problems. Some of the larger users have visited the mines and the mills. Many more should do so. There are few, if any, basic materials now used in manufacturing which offer more complications than feldspar, but the producer has a woeful lack of knowledge of the requirements of the consumer, and, on the other hand, the consumer would be greatly benefited if he understood more fully the nature and the difficulties surrounding the production of a ground feldspar which will successfully meet so many different requirements of analysis and of fusion as are now in effect.

The demand for finer grinding is increasing. It is a fact that a sample of 140-mesh spar will show small black specks when fused that will not appear if the same material were ground to 200 mesh. The consumer should realize that this condition does not make for better feldspar, but on the contrary may result in an average of crude being used which will be of a somewhat poorer quality. No new deposits of especial importance have been discovered, but there is an abundance of crude material.

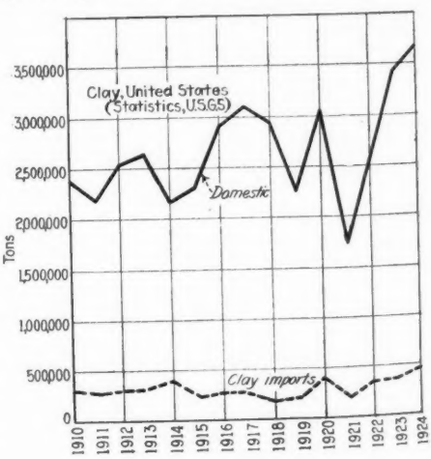
Kaolin

By R. T. Vanderbilt Co.
50 East 42d St., New York

CONSUMPTION of kaolin in the United States continued to increase during 1925, and imports also increased considerably as a result of price cutting in imported grades. No important increases in the producing fields occurred, the largest producing states still being Georgia, South Carolina, Florida, Virginia, and North Carolina. Both foreign and American mines are operating on a very small profit margin, if any.

One new plant in North Carolina was started up in 1925, producing a washed clay. Florida has also another new producer, making a total of four in the state. There are no new operations in Georgia or South Carolina, but the South Carolina production was materially increased by additions to existing plants. In Georgia a noteworthy addition to the state's kaolin industry was the establishment of a plant for the production of a porcelain-face brick from Georgia kaolin.

The outstanding development of 1925 was a marked reduction in the price of the lower grades of English clay as a result of the dissolution of the Clay Producers' Association of England and an organized attempt to secure a still larger proportion of the tonnage in this market. Importers secured also a reduction in freight rates from Atlantic seaboard points to Western markets, which unbalanced the situation in favor of the imported kaolins. The Interstate Commerce Commission's approval of the rates nullified to some extent the small tariff protection now enjoyed by the industry. Imports of 1925 will probably show a total of over 450,000



Clay production

tons. The present import duty is $2.50 per ton, and American producers have now before the Tariff Commission a request for a 50 per cent increase to help them meet this competition. Foreign producers operate at a cost considerably lower than the cost at domestic mines. Practically all of the domestic kaolin is produced in the South, and, with the present duty, the American mines are unable to sell any competitive clay whatever in New England and New York markets, which account for

40 per cent of the consumption. Clay can now be shipped from foreign mines to New England consuming points at a lower freight cost than from the South. The present duty protects the industry only to the extent of 50 per cent of its market.

As to consumption, the proportion going to paper, pottery, paint, and other outlets remains practically unchanged.

Gypsum

By Frank A. Wilder

North Holston, Virginia

ACTIVITY in the building industries, which was expected to reach its peak in 1924, climbed to higher levels in 1925, and carried upward with it the output of gypsum and gypsum products. When the figures for 1925 are compiled, they will probably show an increase of from 5 to 10 per cent in the quantity of gypsum mined in the United States, and a similar increase in gypsum imported from Nova Scotia, New Brunswick, and Mexico.

Imports from Mexico began in the year now under review, the deposits on San Marcos Island, in the Gulf of Lower California, having been recently developed to furnish raw material for plaster mills located at Seattle and Long Beach, California.

Gypsum used in the manufacture of portland cement will exceed a million tons for the year. Of this amount 95 per cent was crude gypsum which was ground with the clinker, the remainder being calcined gypsum. When calcined gypsum is used as cement retarder it is added after the grinding of the clinker. In addition to retarding the set, limited amounts of calcium sulphate increase the strength of the cement.

New mills that began operation durnig 1925 were situated west of the Rocky Mountains. The mills at Seattle and Long Beach, California, have already been referred to. An extensive gypsum deposit has been developed by the Pacific Portland Cement Co., which has constructed a large mill in the vicinity of Imperial Valley of California. The Blue Diamond Plaster Co. built 11 miles of railroad connecting the main line of the Union Pacific and a remarkable deposit of gypsum 30 miles south of Las Vegas, Nev.

In the East, the large mill of the United States Gypsum Co. in New York increased its equipment by the erection of large storage bins to care for extensive reserves of raw material. The output of the mill will in this way be maintained during the winter months when the ports in Nova Scotia are closed by ice. The production of gypsum wall board will show a considerable increase for the year, though the remarkable expansion of this phase of the industry in 1924 will hardly be duplicated. Suits in federal courts covering the folded edge used by some manufacturers of gypsum wall board were decided during the year, but appeals will probably be granted and final decision on some of the points in the controversy can hardly be expected in the near future.

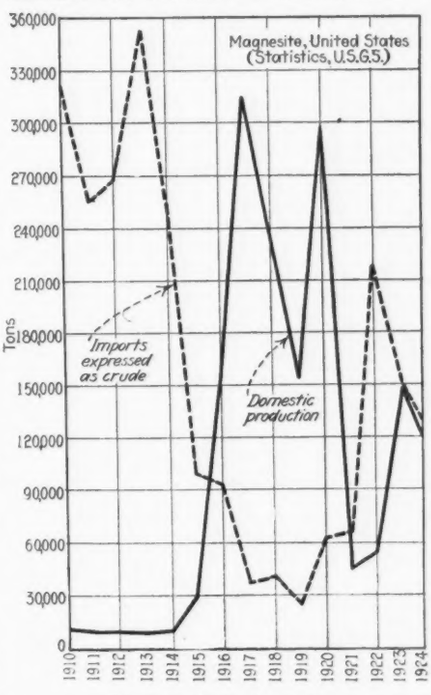
Calcined gypsum, as the cementitious material for use with an aggregate for walls poured in place, entered a new and probably an important field during 1925. Dwellings, garages, and warehouses are being constructed with gypsum floors, roofs, and walls properly and adequately water-proofed. Calcined gypsum in this connection has a number of advantages over portland cement. In the construction of a dwelling of average size from twenty to thirty tons of calcined gypsum may be used, whereas one-tenth of this amount is sufficient if the use of calcined gypsum is confined, as is now the custom, to the interior plastered surfaces. A considerable expansion of the industry in the production of gypsum for the above-named purpose is possible.

Magnesite

Editorial Summary

DOMESTIC magnesite mining, which centers in California and Washington, was subjected to greater foreign competition during 1925, and it is probable that production of crude magnesite for both caustic calcined and dead-burned products will be less than in 1924, when it was 120,100 tons. Imports of caustic calcined in 1925 are estimated at 17,082 tons and of dead-burned 68,419 tons, a total of 85,501 tons, equivalent to 171,002 tons of crude magnesite. Imports in 1924 were equivalent to 129,570 tons of crude, indicating an increase of 41,432 tons of crude for 1925.

Quotational prices equal to those in the last two months of 1924 continued through July of 1925, when they were shaded several dollars per ton and the market became unsettled during the latter part of the year. Shipments of caustic calcined from California increased during the late fall, but these increases were for the purpose of accumulating stocks in distributing centers ready for new business in 1926 and to avoid shipment delays during the winter months.



Magnesite production

There are no alluring features in the magnesite industry for investors, although several attempts were made in 1925 to start fresh enterprises and a few operations were apparently initiated. No new uses were developed during the year. The prospect for 1926 is not especially promising, for there is a move to increase freight rates on intercoastal traffic. As it is, California producers are just about making both ends meet with a low Canal rate.

No new technical developments appeared in 1925, although producers in general, especially the established ones, maintained a high-grade product. Max Y. Seaton states that the magnesite producers are grievously in need of further tariff protection, as foreign labor costs are exceedingly low. The domestic producers have applied to the Tariff Commission for an increase in duty of 50 per cent on caustic calcined magnesite as well as on crude.

Barytes

By S. W. Thompson

Thompson, Weinman & Co., Inc.
52 Vanderbilt Ave., New York

THE conditions under which the producers of crude barytes are mining in the United States differ quite largely from those of past years. All have raised the standard of purity to which the crude material must conform and which standard must be maintained. To obtain this result producers have installed the latest improvements in machinery for washing and separating, by means of rotary screens and jigs which remove the impurities and size the crude material in much better condition for use at the different manufacturing plants. The labor element has been at a standard wage and cannot be reduced.

Producers must face the situation of more foreign shipments into the United States under our present low tariff, and they cannot compete with the lower wages prevailing in foreign countries. It is more apparent every day that not only does crude barytes come in more and more freely, but all the barium compounds are also being imported in quantities and at prices against which no American producer can compete.

There is only one solution to the problem, and that is relief through our tariff committee, which should place a higher import tariff on the foreign crude barytes. No relief is in sight until such action has taken place. The future insures an increased volume of business, and no one understanding the various products now made in the United States from barytes can gainsay the statement that producers should be allowed not only to prepare for this increase of business, but that they should be protected so that they can maintain their industry under competitive conditions established by foreign manufacturers. They should not be compelled to sacrifice several years of hard work and money spent in getting to a satisfactory productive point.

There are virgin deposits of barytes in the United States sufficient for many years to come. Mining has only been started, and by far the greater part of the available acreage has never been even surveyed, owing to various conditions such as distance from railroads and other apparent difficulties, but there is no fear on the part of the American producers that they will have to seek other fields than their own.

Fluorspar

By G. H. Jones

President, Hillside Fluor Spar Mines, Chicago, Ill.

PROMISE of better conditions in the fluorspar industry for 1925 failed to materialize. The large stocks on hand at some of the mines continued to be a menace, as they were not liquidated as expected during the latter part of 1924. Foreign spar, in increasing tonnages, contributed to a weakening of the market.

The determination of two of the large mines to liquidate their stocks of finished spar above ground brought on a fight for all business offered, with the result that the market for desirable tonnages of washed gravel fluorspar of standard grade, 85 and 5, declined to the unprofitable price of $16 per short ton, f.o.b. mines in Illinois and Kentucky.

The tariff continues at $5 per short ton, with no immediate prospect of an increase necessary to protect the domestic industry. Freight rates from the Atlantic Coast continue to favor imports, chiefly from England and Germany, to points as far west as the Pittsburgh and Youngstown districts. Increased demand from the steel companies which use 85 per cent of the domestic production failed to stabilize the market.

The low price referred to, in some cases, does not cover the cost of production with usual overhead expenses included, and takes no account of the price necessary to take care of usual and proper charges for exploration and development work, maintenance, renewals, depreciation, and depletion. Reserves are being depleted, and these cannot be replaced, and a further loss is being sustained by reason of not having this supply to sell in the future at a fair profit.

No new discoveries of fluorspar of any consequence have been reported. Many mines are shut down and will not be reopened under existing conditions. The La Fayette Mining Co., a subsidiary of the U. S. Steel Corporation, is completing its concentrating mill near Mexico, Ky., which is expected to be placed in operation in the early spring. The Franklin Fluorspar Co.'s operations are small at present. The Rosiclare Lead & Fluorspar Mining Co. is apparently pushing operations in its Daisy mine, which is the most active property in the field. The Hillside Flourspar Mines operated upon an average at less than half capacity during 1925. have given up their "Indiana" lease, and have not opened up their Keystone property near Marion, Ky.

The year 1925 will show, when all reports are in, a small production, but larger shipments than were recorded in 1924, much of the spar shipped in that year being from stockpiles. The outlook for 1926 is difficult to determine. For the present, it is not favorable.

Borax

Editorial Summary

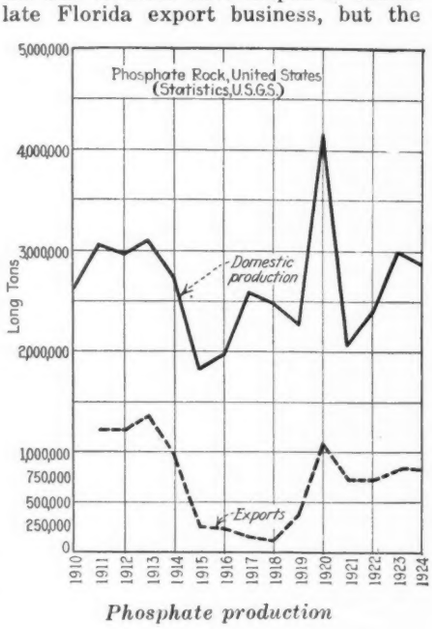
DURING 1925, the borax market was characterized by low prices, quotations ranging from 5¼ to 5½c. per pound at the close of the year. On open quotations business was done around 5c., and even this quotation was shaded. These low prices were the result of competition for business by the three important producers, the Pacific Coast Borax Co., the American Trona Co., and the West End Chemical Co., each of which controls borax deposits. Formerly the Pacific Coast Borax Co. dominated the borax situation, but this is no longer the case, as American Trona and West End have now secured a fair share of the borax market. However, none of the companies is making anything more than a nominal profit. It is highly probable that American Trona and West End are together supplying more borax than Pacific Coast Borax.

Phosphate Rock

By H. D. Ruhm

Mount Pleasant, Tenn.

THE Tennessee phosphate field continued to be depressed throughout 1925 by the surplus production of Florida, which flooded the domestic market on account of so much of the export trade having gone to Morocco. However, the Riff troubles have helped to stimulate Florida export business, but the serious congestion and embargo on all freight shipments resulting from the Florida boom has interfered with domestic consignments from Florida mines. As a consequence the 1925 phosphate rock shipments from Tennessee will exceed those of 1924 by at least 25 per cent. A large increase in lump-rock consumption for producing ferrophosphorus is brought about by the doubling of plant capacity of the ferrophosphorus producers here recently merged into a large iron, coal, and chemical product company.



Phosphate production

The direct use by the farmer of raw ground rock without acidulation increased nearly threefold in 1925 over the record of 1924, and the development in this direction is the great hope for complete restoration of phosphate mining in Tennessee on the basis of the active expansion upon which it had embarked fifteen years ago. Development and improvement of proper methods of saving, in high-grade condition, the enormous tonnage of phosphate fines has greatly increased the reserve tonnage of the Tennessee brown-rock field and gives expectation of a correspondingly increased length of life for the industry. The greatly improved position of fertilizer manufacturers in 1925 as compared with that of 1924 will undoubtedly be reflected by a large increase in the demand for phosphate rock in 1926, and it will not be unexpected if that in turn stimulates active interest and trading in phosphate land, which has been extremely dull for the last four or five years.

Though the first part of 1925 found only one or two of the plants in the Tennessee field in active operating condition, July 1 witnessed a sudden revival, which continued throughout the rest of the year except during September, when the extreme drought cut down the available water supply in the local streams to such an extent as to cause an almost complete shutdown. With the heavy fall rains, however, active mining operations were resumed, and now only two or three plants in the field are idle.

During the last ten years a great change has appeared in operating methods, so that most of the large companies now use "draglines" and power shovels for removing overburden and for mining the deposit. Thickeners, classifiers, and other improved machinery are used in recovering and improving the grade of the fines, once formerly wasted, with the result that even a return to the highest tonnage of the past history would not involve the employment of one-half the number of men formerly required in the industry. A higher proportion of those now employed are, however, more or less skilled laborers.

With the stabilizing of the various industries utilizing phosphate rock as raw material, Florida will continue to supply the European market and the needs of acidulators supplying the fertilizer demand for the cotton fields of the Southeast and for the older lands along the Atlantic and Gulf coasts, while Tennessee will supply the manufacturers of ferrophosphorus, the blast-furnace and chemical demand, as well as fertilizer requirements and raw ground rock for direct use in the upper tier of cotton states and the Ohio and Mississippi valleys. The Western field will supply the great West and Pacific demands.

Nitrate

By A. W. Allen
Assistant Editor,
Chemical & Metallurgical Engineering

ACTIVITY in the Chilean nitrate industry during 1925 was evidenced mainly by the formation and consolidation of powerful combinations. The capitalization of the Lautaro company, for example, has risen from £350,000 in 1923 to £6,650,000 at present. The Guggenheim venture is proceeding along normal lines, and an invitation to the public to subscribe $16,500.000 was recently made in the United States.

The industry, as a whole, remains highly prosperous, and no change in conditions is in sight that would necessitate any reduction in the heavy export tax being levied on the product, by the Chilean Government, which the consumer pays ultimately. Such prosperity is no incentive to the adoption of any general scheme for the betterment of technic in the industry; although foresight is being shown in a few isolated instances. A Bureau of Scientific Research has been formed, sponsored by the Nitrate Producers' Association, of which G. F. Horsley has been named director. Its findings are being awaited with interest.

Recognition of the fact that no Muscle Shoals product is likely to interfere with the sales of Chilean nitrate was merely an incident in the life of the industry that had no more effect on policy than was evident when Henry Ford's name was being so persistently associated with the promise of cheap fertilizer. The production of nitrate in Chile is steadily increasing, although labor troubles occurred in 1925; with prices well maintained. Output for the first nine months of 1925 amounted to 1,971,818 short tons, as compared with 1,904,885 short tons during the corresponding period of 1924. The United States, the industry's best customer, is buying nitrate in increasing amounts.

Potash

By Charles H. MacDowell
President Armour Fertilizer Works,
Chicago, Ill.

A SURVEY of the world's potash industry for 1925 shows satisfactory conditions. More potash was produced and sold than ever before, and at prices which were low enough to satisfy buyers and to assure a reasonable return to producers. Germany continued its operations under syndicate control. In spite of excessive capitalization, represented by over two hundred shafts, a profit has been made by subsidizing the less efficient mines and concentrating operations on fewer than a hundred properties. Germany produced and sold in 1925 the equivalent of about 1,300,000 tons of potassium oxide (K_2O). This tonnage of potassium oxide represents the mining of between 8,000,000 and 9,000,000 tons of potash salt.

French mines in Alsace, operated under state control, have potash deposits extending over seventy square miles, which are estimated to contain an equivalent of approximately 350,000,000 metric tons of potassium oxide, or enough to supply the world, at the present rate of consumption, for about 250 years. Eighteen shafts have been sunk, of which seventeen are in operation. These shafts have a capacity of double the present production. The Alsatian mines have been in operation since 1910, and the production has increased from 42,000 tons (7,000 tons of K_2O) to 1,930,000 tons of potash (300,000 tons of K_2O) in 1924.

Work was begun during 1925 in developing the Spanish potash fields. No figures are yet available as to the extent of their operations, but a small tonnage has been exported.

In the United States the only operation on a large scale is at Searles Lake, California, where a production equivalent to 20,000 tons of potassium oxide has been won from the brine and disposed of in competition with foreign potash, and at a price which has shown a profit. This in spite of the fact that transportation costs to the Middle West and South represent a large percentage of the total sales price. One factor in its success has been the production and sale of important byproducts and the high analysis of the potash. The quality of the American potash is recognized as the equal of foreign potash for both agricultural and chemical purposes.

Other sources of potash supply than those mentioned in preceding paragraphs are almost negligible in quantity. They consist of potash from dried tobacco stems, sugar-beet residue, sunflower seed, cement, and industrial alcohol plants. Some exploration work on the Texas deposits is still being done, but the estimated cost of mining and the high freight rates to consuming points do not offer much encouragement.

French and German producers of potash are working under a three-year sales agreement, which reserves for them the exclusive supplying of their local markets with their own production and provides for the division of the world market on a basis which gives the Germans about 59 and the French 31 per cent. This combination as yet has worked no hardship on the buyer and is the one outstanding instance of foreign monopoly where the sales price has been kept on a reasonable basis.

The price of potash during 1925 advanced in a very small way, but potash in the United States is selling on the average below pre-war prices, in spite of higher fuel, labor, and transportation costs. Prior to the war the German syndicate by law was compelled to sell to the German farmer at considerably lower prices than for export. At present, however, the German farmer is paying practically the same price as the foreign buyer.

Since the taking over of the Alsatian mines by the French Government, the consumption in equivalent potassium oxide in France increased from 36,000 tons in 1913 to 110,000 tons in 1924. French deposits contain on an average about 1 per cent higher yield than those in Germany, and on account of smaller investment and favorable transportation facilities, they have been able to earn satisfactory returns. Germany uses half as much potash as the rest of the world. Holland, in area about the same size as the state of Maryland, consumes about one-third as much as the whole United States. Sales in 1925 by countries are approximately as follows, the tonnage given, in short tons, being the equivalent of potassium oxide: Germany, 850,000; United States, 300,000; Holland, 100,000; Great Britain, 50,000; France, 120,000; Sweden, 35,000; Norway, 10,000; Denmark, 25,000; other European countries, 60,000; other foreign countries, 100,000; a total of 1,650,000 tons.

For the first time since 1914 sales of potash in the United States in 1925 exceeded pre-war volume. This is due in part to the demand for higher analysis formulas, which has raised materially the content of potash per ton.

Both the German and French syndicates look to America to take increased quantities and point to the low consumption of potash per acre here as compared with Holland and Germany. Both maintain active propaganda bureaus in this country. With their tremendous production possibilities they are keeping the selling price on a reasonable basis to encourage consumption and are expecting their largest increase in the future from this country.

Sulphur and Pyrites

By Raymond F. Bacon
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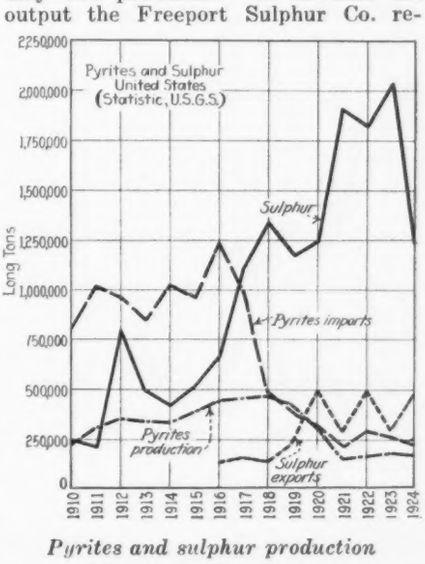
AS ONE of the basic raw materials of industry, sulphur is in a key position to respond to the improvement in economic conditions that characterized 1925. It will be recalled that in early December of 1924 the exhaustion of the Union Sulphur Co.'s deposit in Louisiana was announced. As the scene of Frasch's early work, and the successful culmination of his efforts to mine sulphur by the hot-water process, this deposit has acquired a fame that has been justified by its past performance.

For the first time since 1919 almost the entire United States sulphur production resulted from the activity of only two producers. To increase the output the Freeport Sulphur Co. re-



Pyrites and sulphur production

sumed operations on Bryan Mound in April, 1925, after being out of production for fifteen months. The operations at Hoskins Mound by the Freeport Co. and the operations by the Texas Gulf Sulphur Co. at Gulf, continued without interruption. The output of the two major companies, together with that of several small producers in Western states, will approximate 1,400,000 tons for 1925. Compared with the 1924 output of 1,220,000 tons, there has been an increase of almost 15 per cent, but it is still far below the high average of the years 1921, 1922, and 1923, which was 1,900,000 tons.

Financial and industrial improvement in foreign countries has apparently resulted in a greater proportionate demand for sulphur than has the domestic situation. In 1924, domestic consumption was 1,055,000 tons, which was 100,000 tons short of the 1923 amount. Indications point to a somewhat larger domestic consumption in 1925, approximating that of 1923. Exports, however, for the first nine months show about 30 per cent increase. For 1925 they will undoubtedly be the largest so far attained, and may reach 600,000 tons. The total shipments from American mines will possibly amount to 1,750,000 tons, which likewise is the largest in the history of the American sulphur industry. Compared with the average shipments of 1,390,000 tons for the last five years, it represents an increase of 26 per cent and 10 per cent increase over the largest previous year. The Sicilian production was approximately the same in 1925 as in 1924.

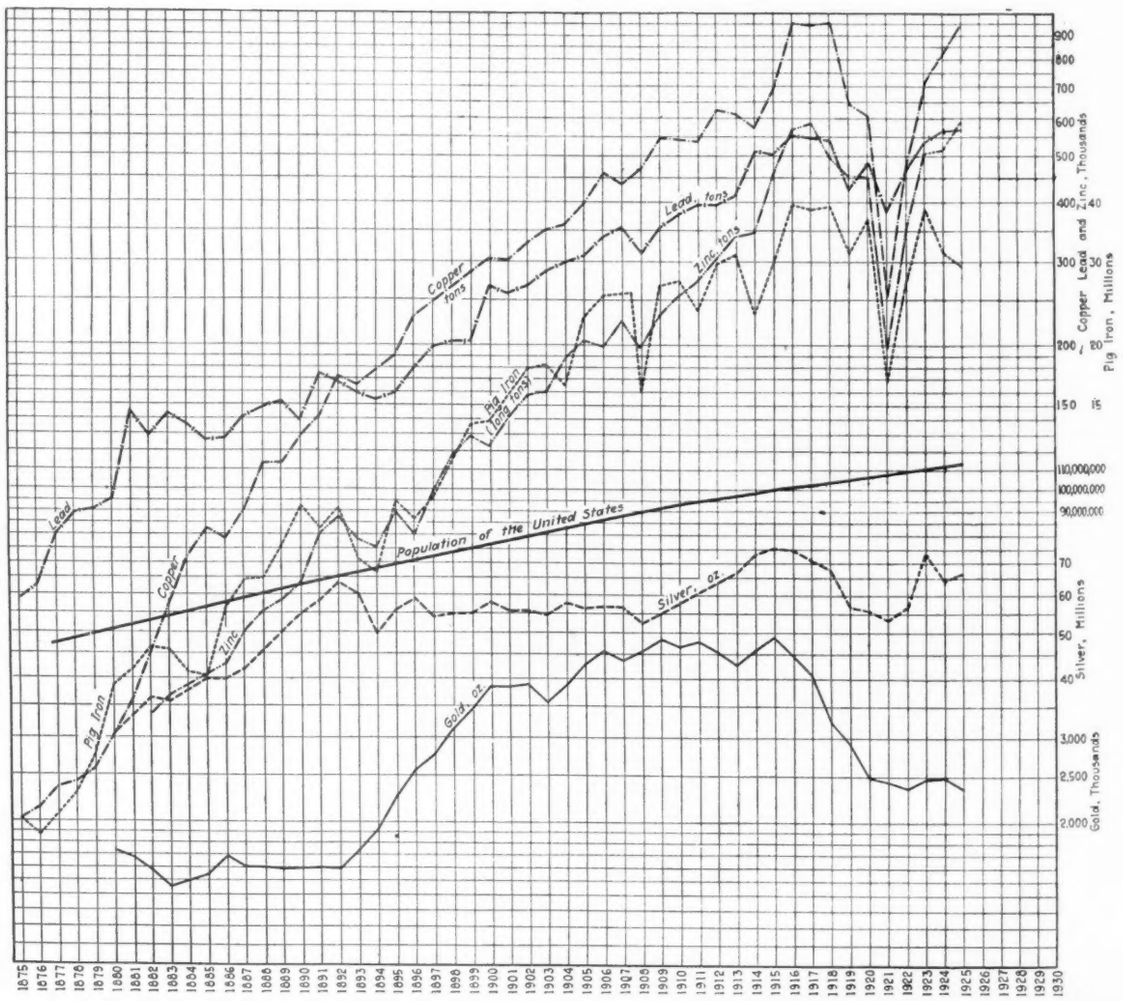
The pyrites situation has improved. Imports of pyrites have come almost entirely from Spain. During the first nine months of 1925 they equaled those of the whole of 1924, and for 1925 imports should total about 300,000 tons, compared with 243,000 tons in 1924. Pyrites advanced over 10 per cent in price in 1925, compared with the previous year. Though larger than any of the preceding four years, the imports were less than one-third of the average for the pre-war period. The situation in domestic pyrites has changed very little, compared with the last few years. Production for 1925 is expected to be approximately the same as for 1924.

Among the factors important for the stability and improvement of the domestic sulphur market might be cited better conditions in the fertilizer and the rubber industries. Steel pickling and oil refining, as large consumers of sulphuric acid, have increased operations somewhat over those of 1924. Rayon production promises to become a large consumer of many chemicals, including sulphuric acid and carbon disulphide. The demand for sulphuric acid, beyond the yield obtained from ores being smelted, has resulted in the use of sulphur by some of the Mid-West zinc producers to boost the sulphur dioxide content of the furnace gases.

For the last two or three years there has been great activity to find new deposits of sulphur that might be workable by the Frasch process. Information available indicates that such efforts have been disappointing, and this has been reflected in a rising tendency of the price of sulphur. Nevertheless, sulphur still remains one of the few commodities selling materially below the pre-war level.

Sulphur is so vitally necessary to a great number of industries that its production and marketing are subject to less violent fluctuations than others more sensitive to the economic pulse. Less than 10 per cent of increase in domestic consumption for 1925 over that of 1924 may appear disproportionate to the relative conditions of industry during the two years. When it is remembered, however, that the 1925 consumption is 25 per cent above the average for the last five years, it is apparent that sulphur justifies the position of those who interpret industrial conditions in the light of its consumption. Marking the peak, both in export and domestic consumption, 1925 may well be said to be the most successful year in the history of the American sulphur industry.

Metal Production of United States 1875-1925



TECHNICAL DEVELOPMENTS

Progress in Mining Geology

Care in Field Investigations—Need of Geologic Research

By J. Volney Lewis
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OUTSTANDING features of 1925 in mining geology are: (1) Great advance in the knowledge of the pegmatites; (2) widespread recognition of orebodies of intrusive origin; (3) increasing use of geophysical aids in geologic exploration; (4) growing demand for greater thoroughness, accuracy, and discrimination in field investigations; and, (5) looming into first importance, the urgent need of geologic research.

Theory and Practice Improving

Geology, like every youthful science, is burdened with speculation and is urgently in need of a broader foundation of exact knowledge. Greater precision of method and accuracy of observation and description are demanded; also, much still remains to be learned of the underlying principles of chemistry and physics. Nevertheless, despite its immaturity, the science is rendering real service. Appreciation of this fact stands out clearly in the plea for a survey of the Rouyn area, for the benefit of prospecting and development, in which the editor of the *Canadian Mining Journal*, in the issue of Feb. 6, 1925, cites the great value of the work of Miller and Knight in the Cobalt district. Similarly, Gowganda is benefiting from the recommendations of Burrows; and Brock's Rossland report is another well-known example.

Pegmatites Pivotal in Development of Ore Genesis

Professor Kemp[1] has pointed to the increasing significance of the pegmatites in the development of views on the origin of ore deposits. It is now well recognized that no line can be drawn between the highly fluid pegmatite magma and the escaping magmatic solutions with their burden of dissolved matter for the formation of veins. Tremendous advance in the knowledge of these pivotal rocks has been made through the researches of Hess,[2] Schaller,[3] Landes,[4] and others on pegmatites in many regions, including the Black Hills, southern California, central Maine, the Adirondacks, Madagascar, and the central Transvaal. In every case extensive replacement, in successive waves, has followed the crystallization of the original dikes. Albite replaces microcline, and even quartz in part; and such minerals as cassiterite, beryl, micas, garnet, tourmaline, lithia minerals, and rarer elements are introduced. The same solutions form vugs and deposit beautifully crystallized minerals in them.

Pegmatite magmas transferred and concentrated the magnetite ores of the Adirondacks, and veindikes of magnetite cut the wall rock and formed the main orebodies, according to Alling.[5] These views harmonize with those of Bayley for New Jersey and North Carolina and suggest a great metallographic province, extending from Canada to the South Atlantic States. Pegmatites and aplites in the Vermilion batholith and adjacent rocks in Minnesota are described by Grout.[6] They range in composition to extremes of three types: (a) nearly pure quartz; (b) nearly pure acid feldspar; (c) about one-half magnetite.

Ore Genesis and Ore-Magma Theory

Spurr's ore-magma theory (1923) has attracted universal interest and stimulated widespread discussion in the mining and geologic world. The ore magma is best conceived as a phase of pegmatite magma. Both are capable of replacement as well as of intrusion; and Phemister[7] has shown that even dry furnace melts are capable of effecting replacement in the linings.

The pegmatitic gold ores at Porcupine were injected as veindikes under heavy pressure, according to Burrows,[8] and the walls are sericitized—impregnated with potash. The ores crystallized partly as veindikes, partly by invasion and replacement of the walls. In the main Dougherty's[9] conclusions are similar. Weed[10] finds that the rich gold ores of the Engineer mine, near Atlin, B. C., were formed as feldspathic veindikes above a rising magma. Later quartz was injected, probably as gelatinous silica, and into the cracks of this the gold-silver solution—an end product of differentiation. Feldspathic ore-bearing solutions, according to Cooke,[11] formed the gold ores of the Argonaut mine, in the Temiskaming district, Ontario. Another set of veins contains albite and much ferromagnesian mineral (probably biotite), chlorite, rutile, graphite, and gold. Cooke also describes the feldspathic gold veins at Larder Lake, which contain oligoclase, albite, muscovite, and much calcite.

Copper-nickel-iron magma, similar to that of Sudbury, separated from the parent norite and crystallized in place, accounts for the nickel deposits of the Bushveld complex, Rustenburg district, Transvaal, according to Wagner.[12] Viscous magmatic ore solution injected into shrinkage cracks formed the copper ores at the Cananea-Duluth mine, Cananea, Mexico, as described by Mitchell.[13] Pegmatite facies of the intrusive, with sulphides, accompany the ore.

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[1] *Economic Geology*, Vol. 19, pp. 697-723.
[2] Frank L. Hess: *Mining Journal-Press*, Vol. 120, pp. 289-298.
[3] W. T. Schaller: *Am. Jour. Sci.*, Nov., 1925; *Mining Journal-Press*, Vol. 120, p. 803.
[4] Kenneth K. Landes; *Am. Mineralogist*, Vol. 10, pp. 355-411.
[5] Harold L. Alling; *Economic Geology*, Vol. 20, pp. 335-363.
[6] Frank E. Grout; *Journal of Geology*, Vol. 23, pp. 467-489.
[7] T. C. Phemister; *Journal of Geology*, Vol. 23, pp. 278-285.
[8] A. G. Burrows: *Mining Journal-Press*, Vol. 119, pp. 865, 874.
[9] Ellsworth Y. Dougherty: *Economic Geology*, Vol. 20, pp. 660-670.
[10] Walter Harvey Weed: *Mining Journal-Press*, Vol. 119, pp. 1037-40.
[11] H. C. Cooke: Canadian Geological Survey, *Summary Report* 1923, Pt. CI, pp. 42-60.
[12] Percy A. Wagner: Geol. Survey S. Africa, *Mem .21*; *Economic Geology*, Vol. 20, pp. 296, 297 (review).
[13] G. J. Mitchell: *Mining Journal-Press*, Vol. 119, pp. 45-48.

Evidence of veindike injection at the Camp Bird Mine,[14] Colorado, is found in suspended angular wall fragments and slabs of limestone brought up from Paleozoic sources several thousand feet below. Other remarkable features include the control of horizontal distribution by the local strike of the vein; the upper limit of ore by an andesite flow above tuff; and the bottom at depths of 600 to 700 ft. in tuff. The vein continues beyond these limits, but without gold. The oreshoots rake eastward, and the horizontal dimensions are greater than the vertical. Spurr regards the porosity of the tuff as the factor that fixes the upper limit of values.

Striking resemblances to the Camp Bird are found in the gold veins of the Zaruma district, Ecuador, described by Billingsley.[15] The lenticular oreshoots rake northward, the vertical dimensions are less than twice the horizontal, and the maximum mineralization and richness of all are at the same horizon.

Spurr[16] calls attention to the fact that the standard gold-quartz vein (Porcupine, Victoria, California) often contains albite (never potash feldspar) and the walls are enriched with potash, with the development of sericite. The vein is chemically different from the solution excluded from it on crystallization. The same author[17] has also discussed the scanty basic dikes that often accompany ore deposits. These are essentially contemporaneous with, or even later than, the ores, signifying that both crystallize about the same low temperature, both having been kept liquid by volatile constituents.

The famous zinc deposits of New Jersey have been studied by Spurr and Lewis,[18] who show that the ores occupy veins (not beds). They were probably injected as zinc-iron-manganese sulphide magma, derived from the neighboring granite-monzonite batholith. Continued invasion by granite magma raised the temperature and roasted the sulphides to oxides and silicates. The intensely localized zinc ore, in contrast with widespread and abundant magnetite, points to a rare and highly differentiated form of magma.

An unusual type of copper deposit at the Caridad mine, Sonora, Mexico, is described by Wandke.[19] The ore minerals (enargite, tennantite, and bornite) are associated with a gangue of quartz, sericite, barite, and alunite—a shallow depth hypogene deposit. The presence of barite and alunite suggests that late stages of mineralization may be characterized by sulphate solutions, magmatic water perhaps acting as the oxidizing agent of sulphides at low temperatures.

The ore of the Mansfield Kupfershiefer, Germany, consists of narrowly localized lenses and disseminated grains of bornite, chalcocite, and later chalcopyrite in bituminous shale. Trask[20] reviews the papers of several recent investigators, all of whom reject Beyschlag's theory of magmatic origin in favor of some syngenetic hypothesis. The source and the manner of deposition and localization of the sulphides remain unsolved problems.

The origin of the ore at the famous Homestake mine, South Dakota, is attributed by Page[21] to invasion of Algonkian granite at a late stage in the metamorphism of the schists, with minor Tertiary enrichment.

Injection and Crystallization

Billings[22] has shown that the Medford dike, in eastern Massachusetts, was intruded without offsetting older cross-dikes. Hence the walls were not pushed aside. The author concludes that the displaced rock sank in the rising basaltic magma. The alternative that it might have been pushed up seems possible with both dikes and veindikes.

Rothrock[23] finds that growing crystals of calcite have moved considerable bodies of rock and have split grains of quartz, which has a tensile strength of 18,000 to 23,000 lb. per square inch. It is thought that such a force may be effective in opening fissures.

Colloids, Diffusion, Adsorption

Boydell[24] summarizes the rôle of colloidal solutions in the formation of mineral deposits, with emphasis on precipitated colloids (which may afterward crystallize) and replacements. The possible explanations for some of the perplexing features of ore deposits probably have not yet been exhausted. A gel-stage seems probable in many veins, openings for the entrance of new material being provided by shrinkage and crystallization.

An instructive experiment by Merritt[25] has demonstrated that substances of low specific gravity may support heavy inclusions. A silica jelly containing 95 per cent water sustained inclusions of galena, with no appreciable settling in two weeks. The author points out that the diffusion of water into the walls would leave the colloidal vein matter behind, and the walls would be altered by the noncolloidal portion of the injection.

Correns[26] has shown by experiment that many rocks, by adsorption alone, may acquire a little copper or lead from dilute solutions, but the higher percentages of commercial ores are thought to be impossible. Ransome[27] points to the occurrence of amygdules in sealed cavities as evidence that diffusion may be a factor in the formation of ore deposits.

Andrews[28] points out the remarkable unity of the Pacific region, as shown by the ore deposits. From the Pacific border of deeps, earthquakes, and volcanoes landward lie successive zones of mineralization of increasing age and stability. The mineral veins of British Columbia fall into two systems, according to Schofield,[29] the northwesterly being chiefly copper in shear zones, the northeasterly mainly gold and silver-lead in fissure veins. Beeson[30] finds production in Utah definitely related to structure and erosion, the latter bearing an inverse relation to production.

Geologic Aid to Prospecting

Geology is not yet ready to take command as a sure guide to ore; but it can render valuable assistance, and with the advance of mining and of scientific research geology will also advance steadily toward that ideal.

[14] J. S. Spurr: *Mining Journal-Press*, Vol. 119, pp. 517-529; *Economic Geology*, Vol. 20, pp. 115-152.
[15] Paul Billingsley: *Mining and Metallurgy*, Vol. 6, pp. 614, 615.
[16] J. E. Spurr: *Mining Journal-Press*, Vol. 119, p. 890.
[17] J. E. Spurr: Geol. Society Amer., Ithaca meeting, Dec., 1924; *Mining Journal-Press*, Vol. 119, p. 554.
[18] J. E. Spurr and J. Volney Lewis: *Mining Journal-Press*, Vol. 119, pp. 317-328.
[19] Alfred Wandke: *Economic Geology*, Vol. 20, pp. 311-318.
[20] Parker D. Trask: *Economic Geology*, Vol. 20, pp. 746-761.
[21] Sidney Page: U. S. Geological Survey, Folio 219.
[22] M. P. Billings: *Journal of Geology*, Vol. 33, pp. 140-150
[23] C. P. Rothrock: *Journal of Geology*, Vol. 23, pp. 80-83.
[24] H. C. Boydell: *Bull. Inst. Min. and Met.*, Dec., 1924; *Canadian Mining Journal*, Vol. 46, pp. 51, 52, 235.
[25] C. A. Merritt: *Economic Geology*, Vol. 20, pp. 602-604.
[26] C. W. Correns: *Zeitschr, prak. Geologie*, Vol. 32, pp. 145-154.
[27] F. L. Ransome: *Economic Geology*, Vol. 20, pp. 485-490.
[28] E. C. Andrews: *Economic Geology*, Vol. 20, pp. 707-722.
[29] S. J. Schofield: *Can. Inst. Min. Met.*, Feb., 1925; *Mining Journal-Press*, Vol. 120, p. 963.
[30] J. J. Beeson: *Mining and Metallurgy*, Vol. 6, p. 438.

Wagner[31] believes that Spurr's theory of the zonal deposition of metals gives promise of practical assistance in the search for deposits, if applied with due caution and judgment. De Lury[32] has applied the theory to the ore deposits of Manitoba and has drawn conclusions for guidance in prospecting. Schofield advises prospecting in the valleys and other depressions that belong to the two vein systems of British Columbia, referred to before.

Further studies in leached croppings as guides to prospecting have been contributed by Blanchard and Boswell.[33] Supplementing the research on mixed pyrite and chalcocite, by Morse and Locke in 1924, these studies of pyrite and chalcopyrite mixtures find the outstanding characteristics to depend on the behavior of the liberated iron.

Of the geophysical aids that may be utilized in ore finding, Lundberg and Rogers[34] find that gravimetric, seismic, and magnetic methods have great value in simple cases, but electric methods have wider application to ores. An impressive number of successes have been achieved, and all give promise of developing into useful tools for the geologist. Further advances seem foreshadowed in recent experiments with electric methods in conjunction with aircraft, opening up possibilities for the survey of great unexplored areas. They seem to be based on sound principles and should be tried out and perfected.[35]

Geologic Research Urgent

The need for intensive geologic research has been urged by Spurr[36] and Ransome,[37] but no institution is now equipped to carry it on. Here is an enticing field for the mining man with money which he wishes to spend in good and profitable work. Ransome has noted some of the outstanding problems connected with ore deposits, including also some fundamental chemical and physical questions. From various sources comes the demand for detailed and critical field studies of ore deposits and more adequate descriptions. It is hoped that these may eventually take the form of life histories of mines, based on continuous study and record during extraction, as so cogently urged by Brock.[38] Mining removes much of the evidence of origin and distribution and leaves most of the rest concealed or inaccessible.

[31]Percy A. Wagner: *Economic Geology*, Vol. 20, pp. 282-285.
[32]J. S. De Lury: *Bull. Can. Inst. Min. Met.*, Oct., 1925, pp. 931-940.
[33]Roland Blanchard and P. F. Boswell: *Economic Geology*, Vol. 20, pp. 613-641.
[34]Hans Lundberg and Allen H. Rogers: *Mining and Metallurgy*, Vol. 6, pp. 229-233.
[35]H. Shaw: *Economic Geology*, Vol. 20, pp. 391-395.
[36]J. E. Spurr: *Mining Journal-Press*, Vol. 119, pp. 993, 994; Vol. 120, pp. 921, 922.
[37]F. L. Ransome: *Economic Geology*, Vol. 20, pp. 485-490.
[38]R. W. Brock: *Economic Geology*, Vol. 19, pp. 674-676.

Mining Practice

Power Loading—Electrical Prospecting—Mining Methods—Ventilation

By George J. Young
Associate Editor, *Mining Journal-Press*

TECHNICAL DEVELOPMENTS in mining during 1925 are characterized by a consistent endeavor to lower costs by systematic development and refinements of methods, but are not marked by any striking novelties. The important contribution of the year in mining literature is C. R. Van Barneveld's report[1] on "Mechanical Underground Loading in Metal Mines." This is a compendium of experience which is illuminating. It indicates the efforts made to increase labor output by the substitution of mechanical methods of loading or of moving broken ore over short distances, either horizontal or inclined. Mechanical ingenuity has been shown in many devices. These now appear to fall into three broad divisions: The scraper, with its accessory double-drum hoist and various designs of loading inclines; the mechanical loader of moderate weight, and the heavy mechanical loaders. The last named are restricted to workings which are flat and of comparatively large size. The first two are useful under a variety of mining conditions.

Aids to Prospecting

Geophysical aids to prospecting continue to attract interest, but actual examples of the results obtained by various devices are not published and the information about them is confidential. However, Sherwin F. Kelley states[2] that by the use of the Schlumberger method several orebodies have been discovered in northern Rhodesia. I venture the opinion that only a nominal success has attended their use and that much experience is necessary before the indications obtained by these appliances can be accurately interpreted. Undoubtedly a group of specialists will be developed who will render important service to the mining industry.

Lundberg and Rogers[3] summarized their studies of the subject and reiterated the need for participation of experienced geologists in field investigations. They state that electric methods are most important in prospecting for orebodies and that magnetic methods can be looked upon as a special part of the electromagnetic methods applicable where the primary field has one direction only. By applying electrical methods to magnetic orebodies, greater information can be obtained than by magnetic methods alone. Both state that the outlines of an orebody, as a rule, may be determined by electric methods; the depth of the covering soil by seismic methods, and the physical characteristics of the ore by electric and gravitometric methods. In prospecting for oil, coal, and salt deposits, where knowledge of the stratification is fundamental, the gravitometric and seismic methods have proved, so far, most important.

G. Bergstrom[4] discusses electrical prospecting and gives three conditions for success: First, that the ore must be a better conductor than the country rock; second, that the orebodies must have decided horizontal extension, the most ideal forms being lodes and veins; and, third, that variations in electric conductivity must be at hand in or under the area to be investigated. Under the foregoing conditions, Bergstrom states that the position of the orebody with respect to width as

[1]Missouri School of Mines and Metallurgy, Rolla, Mo.
[2]M. & M., Vol. 6, p. 354.
[3]M. &. M., Vol. 6, p. 229.
[4]J. C. M. & M. Soc., S. A., Vol. 26, p. 34.

well as its length and the approximate depth of the electrical axis can be determined.

Efforts are being made to develop the Chilson method, which employs radio equipment and determines the position of an electrical axis by the investigation of secondary magnetic fields formed by induced currents in the underground conductor. A high frequency broadcasting current is employed, and the secondary fields are tested out by a radio direction finder. No important results of the operation of the device have as yet been recorded.

An interesting application of electric methods[5] is being made to locate accurately the position of water inflow in oil wells. An electrical resistance apparatus is used. It consists of a galvanometer, resistance bridge, duplex conductor coil, electrodes, and a source of alternating current. The resistance of the solution between fixed electrodes is measured. The well is first conditioned by washing with fresh water until the outflow is comparatively fresh as determined by its resistance. At the point of inflow of the salt water the resistance of the well fluid is lowered. Inflow is caused by bailing sufficient fluid. The resistance is measured at successive points in the well by lowering the electrodes and cable. Experience and an accurate knowledge of the well conditions are necessary to interpret accurately the resistance measurements. R. L. Keyes is of the opinion that the new instrument is valuable in the hands of the experienced engineer and geologist in their oil-well control work.

Open-Pit Mining Makes Few Advances

The mechanical equipment now available for open-pit mining includes electrically operated shovels mounted on caterpillar tractors, air-dump cars, track shifters, and spreader plows, all of which have been mechanically developed to a high degree of operating efficiency. Steam equipment is used where conditions are unfavorable for electrical power. The larger revolving shovels find application also under special conditions. Robert Marsh, Jr.,[6] has summarized the characteristics of the mechanical equipment of open-pit mines, and D. J. Shelton[7] has discussed the features of the electric shovel. Marsh comments on the variety of methods used in drilling and blasting. He points out the desirability of well drills for benches of greater than 30 ft. in height and the limitation of tunnel blasting to high banks, 100 ft. or more, and to rock masses which are characterized by on-edge or tilted formations rather than by horizontal stratification. The increased efficiency of a mixture of different-sized grains where black powder is used is shown and the advantages of Cordeau-Bickford fuse with black powder and other explosives are indicated. Marsh is an advocate of thorough tamping.

Operating details of the open pit of the Utah Copper Co., in Bingham Canyon, Utah, are given by H. C. Goodrich[8]. He states that the electric shovel has about the same digging capacity as the steam shovel of similar size, but the former has the advantage of lower cost in direct operation as well as an indirect saving. This amounts to 23.7 per cent of the operating labor cost of the steam shovel and 79.6 per cent of the operating material cost. The cleanliness of the electrical shovel and the absence of smoke and steam contribute to greater safety in operation.

Applications of the glory hole method of quarrying limestone have been described in the case of certain California quarries[9]. The systematic development of this method by R. A. Kinzie is of considerable interest. Kinzie makes use of a series of large bulldozing chambers each of which is served by a 10x10-ft. vertical raise, which terminates in a funnel-shaped pit the sides of which are benched off by 20-ft. drill holes and blasting. Each bulldozing chamber serves six chute raises tributary to two parallel haulageways 30 ft. below. Two parallel drifts give access to the bulldozing chambers through crosscuts opposite each chute raise. Intermediates are driven to the transfers at vertical intervals of 40 ft. from a manway raise centrally placed with respect to four bulldozing chambers. Timbering except at the chute mouths is unnecessary, as the limestone is compact. In another paper[10] methods are suggested for smaller deposits and outputs of nominal magnitude. These are modifications of underhand stoping methods. In addition underground methods of mining limestone are discussed.

Mining Methods Present Variety

Breast stoping in a thin bed of iron ore, the ore being used for pigment, is described by W. S. Black[11]. A modification of the advancing long-wall method is used, as the deposit is flat and at a shallow depth. The ore, 30 in. thick, is first blasted out and removed. The overlying shale is then broken down and used for building a pack wall 6 or 7 ft. back from the face. Another cut is then started. Haulageways are at intervals of about 60 ft. Jackhammers mounted on tripods are used for drilling.

Methods of mining narrow veins are discussed by R. Emmet in the case of the Zaruma district, Ecuador; by R. T. Mishler and L. R. Budrow in the instance of the Lucky Tiger mine, and by J. F. Park, who briefly describes methods employed in the Jarbidge district of Nevada. These papers are published in the *Transactions* of the A.I.M.E. None of the methods are novel. In the Zaruma district horizontal cut-and-fill and incline cut-and-fill have displaced shrinkage stoping chiefly because the vein walls are weak. At the Lucky Tiger, shrinkage stoping is used where walls are firm, and under other conditions horizontal cut-and-fill. Incline cut-and-fill is used where walls are fairly firm and the vein is wide and requires no sorting. At Jarbidge shrinkage stoping is the method principally applied. The most complete figures are given in the Jarbidge example, where the tons per man-shift are 3.34; explosives per ton 1.75 lb.; timber 2.62 bd.ft., and power 11.25 kw.-hr. per ton.

Mother Lode mining methods are presented by S. L. Arnot[12] in an interesting paper about a district which is represented scantily in technical literature. Arnot states that incline and horizontal cut-and-fill and shrinkage stoping have been employed, but that the principal method is overhand stoping with square-set timbering. Sill timbers are placed normal to the walls where orebodies are 15 ft. or less in width and, in wider orebodies, they are placed horizontally. Stoping practice is without special novelty, although it is to be noted that caved

[5] "California Oil Fields," Vol. 10, June, 1925, p. 6.
[6] *Mining Journal-Press*, Vol. 119, p. 643.
[7] *Mining Journal-Press*, Vol. 119, p. 601.
[8] *Trans.*, A.I.M.E., September, 1925.
[9] *Mining Journal-Press*, Vol. 120; pp. 13, 249.
[10] *Mining Journal-Press*, Vol. 120, p. 493.
[11] *Mining Journal-Press*, Vol. 119, p. 927.
[12] *Trans.* A.I.M.E., Sept., 1925.

orebodies are mined by combined incline and vertical slice, stulls being used and filling, supported by lagging, being placed in each slice after it is finished. The ratios of labor and supplies are in most cases high—tons per man-shift in stopes about 4; all underground men 2.32; explosives, 0.83 lb. per ton; timber, 20.86 bd.ft. per ton, and power, 29.8 kw.-hr. per ton. Labor cost is 58.2 per cent of the total direct mining cost and supplies amount to 32.2 per cent.

In wide vein mining W. C. Browning and F. W. Snow[13] describe the methods used at the Magma mine (Arizona). Rill stopes supported by square-set timbering are restricted to 30 ft. in length and 100 ft. in height, the distance between levels. A 7-ft. slice is mined and flooring used. Two square sets on each end of the stope are carried for manway and ore-pass purposes. They are used for waste filling when the contiguous blocks are mined. Another method is similar to the Mitchell stoping system. The orebody is blocked out in 15-ft. units along the strike. Every other unit is a rill stope, which is waste filled from waste transfers at the hanging wall, ore passes being constructed on the footwall. Intervening pillars are underhanded, stringers and segment sets being placed between the timbers of the rill stopes.

Methods in use at the United Verde copper mine were described in the *Mining Journal-Press*[14]. Open-pit mining accounts for part of the production, but the principal part is from horizontal cut-and-fill stopes, which are carried the full width of the orebody. The stopes are separated by pillars at intervals. Support within the stopes is by timber bulkheads erected upon the fill. Shrinkage stopes are operated in part of the mine. A feature of recent practice is the starting of stopes on sill floors a sufficient distance above the gangways to relieve them from all weight coming from the filled stopes and thus reduce gangway maintenance to a minimum.

Homestake mining methods are discussed by A. J. M. Ross and R. G. Wayland[15]. This interesting mine is now worked by modified shrinkage stoping. The orebody is divided transversely into alternate pillars and stopes, the former 42 ft. and the latter 60 ft. The stope is mined out on the sill floor and is then filled with a hogback of waste, timbered drifts with chutes being placed at the sides of the stope and held in place by the waste fill. Before running in the waste from an axial rise, the sill floor is covered with a layer of used timber. The stope is then extended upward as a shrinkage stope to within 20 ft. of the level above. It is then emptied and filled with waste. The remaining ore as well as the ore in the pillars is mined by overhand stoping with square-set timbering. Blockholing is done in the stopes. Ratios are 20 tons per man-shift for miners; 6 tons per man-shift for all underground labor; 0.6 lb. explosives per ton; 2 bd.ft. timber per ton, and 13.06 kw.-hr. per ton for power.

In undercut caving methods, McHenry Mosier and others of the mine staff at the Humboldt mine, Morenci, Ariz., have developed an interesting modification which has been called the "Morenci timbered-slide method." Short inclined raises are extended from pony sets above a gangway, at intervals of 20 ft., alternating on either side. These are heavily timbered. A parallel cut is taken out above the raise, and from this at intervals of 10 ft. narrow drifts are extended parallel with the gangway. Holes are drilled in the tops of the drifts and into pillars which are blasted along the end of a block 150 ft. in width and cut off on the sides by 6-ft. shrinkage stopes that are driven well in advance of the undercutting. The caved ore is drawn through the timbered inclines. The method gives a lower development cost and is successful for lifts of 100 ft. At the Miami mine a new undercutting method has also been developed, but this has not been described. J. E. Harding[16] described a proposed method of undercutting in which he plans to drive short raises from a grizzly level, enlarging the raises and drilling the backs with numerous holes. The co-ordinate system is laid out in squares 26 ft. on a side and the undercutting chamber in each square varies from 10x10 to 13x13 ft. Undoubtedly this method has already been applied. S. J. Goodney[17] describes a method of top slicing in which he proposes to use a system of short chute raises for loading out the ore in a slicing unit. The chute raises are extended from the development workings on the slice beneath the slice being mined. A system of under chute raises similar to this has been in use at the Old Dominion mine for a long time, and hence there is no novelty in the proposal.

In a recent paper in the *Transactions* of the A.I.M.E., R. J. Mechin describes the application of top slicing at El Bordo mine, Mexico. He gives credit to T. C. Baker for the introduction of top slicing in the Pachuca district. The top-slice units are 65.6 ft. long, average width, 23.9 ft. and 12 ft. high, each being centered upon a preparatory crosscut 3x5 ft. which enters the orebody from a 4x7-ft. raise, 16 ft. in the footwall of the orebody. The unit is opened out by a drift driven in the compact ore. When the ends of a room are reached crosscuts are driven on both sides to the footwall and to the pay limit in fills on the hanging wall. The unit is retreated to the crosscut from both ends. Round posts with head blocks are used at 4-ft. intervals. Floors are laid upon stringers consisting of double planks 2½x8 in. by 13 ft. in length, 42 in. apart. Floor planks are 2½x8 in. by 13 ft. Posts are recovered as far as possible before blasting. Costs are 78c. per ton; 3.14 tons per man-shift is obtained with 11.6 bd.ft. of timber per ton and 0.23 lb. of explosives. The interesting feature is the application of top slicing to relatively narrow veins. Baker is using a similar method at Virginia City, Nev.

Rock Drills and Drilling

Although replaceable drill bits have ceased to attract much attention, efforts to utilize this idea are still being made. W. J. Coulter[18] describes a form of replaceable bit in more or less successful use at Anyox, in British Columbia. The Numa bit is being tried out. It consists of a single cutting edge, 90 deg., with a tapered base which fits into a corresponding socket of the drill rod. A larger hole is necessary. As in other cases the hardness of the rock determines the economy of using detachable bits as compared to ordinary steel. Where the drilling speed exceeds 4 in. per minute detachable bits have proved satisfactory. In hard rock the breakage of shanks, sockets, and steel is high, but even under such conditions the work of the detachable bits compares favorably with the other steel.

[13] *Mining Journal-Press*, Vol. 119, p. 197.
[14] *Mining Journal-Press*, Vol. 119, p. 357; p. 397.
[15] *Trans.* A.I.M.E., Feb., 1925.
[16] *Mining Journal-Press*, Vol. 119, p. 812.
[17] *Mining Journal-Press*, Vol. 119, p. 651.
[18] *Mining Journal-Press*, Vol. 119, p. 530.

same meeting A. J. McDermid discussed in detail a new system for the transportation and distribution of mine supplies in use by the Miami Copper Co. This paper, published by the *American Mining Congress Journal*, is suggestive of important ways by which time lost in waiting for tools and supplies can be reduced to a minimum. E. Leland presented in the *Mining Journal-Press* of Aug. 1, 1925, a similar paper in which he outlined the supply distribution practice at Nacozari. Both of these papers are well worth careful study by large mining organizations. A. C. Stoddard discussed at the Mining Congress meeting the transportation and hoisting methods in use at the Inspiration mine and Frederick W. Snow covered the same subjects in the case of the Magma mine. Both papers are interesting and are useful in placing on record the practice at these two important mines.

The subsidence of formations overlying stopes and underground chambers is discussed at considerable length by W. R. Crane[3a]. Many examples from the Birmingham district, Alabama, are given and attempts are made to draw deductions, but his report cannot be considered as final.

[3a]Supplement, M. & M., Aug., 1925.

Milling and Flotation

Increase of Flotation—Growing Importance of Selective Separation

By Charles E. Locke
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UNQUESTIONABLY, 1925 will stand out as a year of progress in metallurgy, owing to the revolution in flotation. Not only has the general use of flotation increased, with a corresponding decrease in gravity concentration, but also the rapid adoption of the new xanthate reagent in a lime pulp has greatly improved conditions, so that in the treatment of copper ores carrying pyrite the pyrite is wasted with the tailings, and the resultant large saving has been helpful in partly offsetting the continued low price of copper. Differential separation of lead, zinc, and iron sulphides from one another likewise has continued to gain, and thus many more dollars have been added to the miner's pocket. More oxide lead ores are being floated and a good start has been made on the flotation of oxide copper ores.

In crushing apparatus nothing especially new has appeared. Large-scale crushing is fairly well standardized into four steps—jaw or gyratory breaker to about 6 in.; gyratory to 4 in.; rolls or Symons disk to 1 or 1½ in.; below 1 in., ball or rod mills in one or more steps, to table or flotation feed. There appears to be a tendency in some mills to add rolls as the last stage before the ball or rod mill. Thus, in the new addition to the Miami copper mill, 78-in. rolls will make a further reduction from ⅝ in. to ¼ in., instead of sending ⅝-in. feed to the ball mills as formerly. This will increase the capacity of the ball mills. On the other hand David Cole[1] has interpreted the comparative results from Symons disks and rolls in the New Cornelia mill to indicate conclusively that Symons disks are superior to rolls for intermediate crushing. The choice is divided between ball mills and rod mills for fine reduction. Where a cheaper installation is desired, the former machine is to be used.

Rubber linings for ball mills are still in the experimental stage. Improved results are reported by the substitution of other forms of grinding media for spherical balls. Some mills use special shapes; others employ slugs made by cutting up old scrap. Gravity stamps continue to lose ground. Some valuable figures on crushing and grinding costs and wear of metal in the United Eastern mill have been supplied by E. M. Bagley.[2] From E. W. Davis[3] has come another classic report which summarizes the results of his investigation of ball-mill crushing in closed circuit with screens between the range of 14 and 65 mesh. This has demonstrated that the greater the amount of material to be crushed that is fed to a ball mill, the greater the amount of work that the mill will do; that the increase is rapid up to the point where the circulating load is 50 per cent of the feed and then becomes more gradual; that closed-circuit grinding always produces material of more uniform size than open-circuit grinding, and that closed-circuit grinding with screens produces a more granular product than closed-circuit grinding with classifiers. The U. S. Bureau of Mines at the Salt Lake Station is making a searching investigation of the fundamental theory of crushing.

Advances in Screening and Classifying

In the field of screening, classifying, and settling, some advances have been made. Vibrating screens continue to replace other forms of screens. Continued success of the Fahrenwald constant-density classifier is reported in the Bunker Hill & Sullivan mill in Idaho. Installations have been made in other parts of the country and on a wide range of problems such as in closed-circuit grinding and in preparing feed for tabling and flotation. The excellence of its work is an appreciable factor in improving gravity concentration and thus resisting the tendency toward all-flotation. This apparatus has demonstrated its ability to even separate a 200-mesh granular product from slime. A new field has been found for the Dorr classifier in washing Mesabi iron ores, where it is taking the place of log washers and doing the work more efficiently and economically.

A new development in thickeners is the Golden Cycle superthickener and clarifier described by N. Cunningham.[4] This combines thickening and filtering in a circular tank, employing the usual form of revolving rakes, by adding a suction filter bed of sand in the bottom. The rakes remove a thin slice of this sand bed

[1]*M. & M.*, Vol. 5, p. 524, 1925.

[2]*Mining Journal-Press*, Vol. 119, p. 436, 1925.
[3]*Bull. Univ. Minn. Experiment Station*, Vol. 28, No. 42, Aug. 27, 1925.
[4]*Mining Journal-Press*, Vol. 119, p. 905, 1925.

G. Bergstrom and L. Nordenfelt[19], in their studies of drill steel, state that it is not difficult to get good drill steel, chiefly because of the keen competition between manufacturers. They point out that the only satisfactory test of several different steels is their practical use, laboratory tests failing to bring out the important facts. For use in sharpening of drill steel, the general introduction of pyrometers is advocated.

An excellent paper by Charles A. Dobbel[20] gives details of the practice in deep-hole drilling for prospecting. A cast-steel sleeve is used to connect sections of hollow 1¼-in. drill steel the ends of which have been threaded by forging in dies. A McClennen cross-bit is used. A water-jacket swivel is placed close to the drill to introduce a heavy stream of water. A large hammer drill is required. Holes are started at 3⅛ in. in diameter and drill bits reduced by ⅛ in., eight reductions or corresponding drill changes being possible before the diameter of the hole is reduced to that of the sleeve. Vertical holes of 100-ft. depth have been drilled. With a light rig and 1-in steel, holes are drilled to 150 ft. and with a heavier rig and 1¼-in. steel to 200 ft. The best drilling holes are from 20 to 30 deg. above the horizontal. Flatter holes are difficult to clean. Above 45 deg. there is the difficulty of the weight of the steel. Ground which is fractured is another difficulty. Cost of drilling is about $1 per foot, 25 to 30 ft. being made per shift. Diamond drilling cost on the average $4.94 per ft. Other uses for deep-hole drilling, especially in draining areas in advance of mining, have been found advantageous. The hardness of the rock is the chief limitation to the use of this method for prospecting.

Ventilation Practice Increasing

Widespread use of mechanical ventilation is now a feature of metal-mine operation. Supplementary ventilation of stopes, dead ends and isolated workings is generally provided by small power fans and flexible tubing as well as the usual air pipe. In long tunnel work, wood-stave pipe has proved satisfactory in conjunction with rotary blowers of the Connellsville type, and some of these are used in metal-mining practice. Small compressed-air operated blowers of a portable type have been developed and used for "air-stirring" in hot stopes.

On the engineering phase of the subject, W. S. Weeks and J. T. Rutherford[21] have given tables for the drop in pressure in airways due to friction. G. E. McElroy and A. S. Richardson[22] gave a new set of friction factors for metal mine airways, and J. W. Paul, H. P. Greenwald, and G. E. McElroy[23] a similar set for coal-mine entries.

The cooling of mine air is discussed by T. T. Read[24], who instances the Morro Velho mine, where a refrigerating plant is employed, and comments also upon the use of silica gel for drying air. J. H. Veasey[25] discusses at length the cooling of mine air and describes a new process, known as the "Carrier" process, which utilizes, as a refrigerant, a liquid in the ethyl-chloride group which is odorless, non-poisonous, non-explosive, and non-inflammable. Its boiling point is about 125 deg. F., at atmospheric pressure. The evaporator must operate under vacuum, and a rotary compressor can therefore be used, permitting of a simple, compact, underground installation. Veasey describes in more or less detail the features of the new system. R. R. Sayers[26] discusses the physiological effects of high temperatures and humidities and the health hazards in the mining industry. This is a general summary.

Hoisting and Mine Surface Plants

The shaft equipment at the Porphyry shaft of the Inspiration Consolidated Copper Co. is described in detail by George H. Booth[27]. This is another example of conscientious design of mechanical equipment and shaft construction. Concrete and steel are the chief materials used. F. R. Grant[28] gives the details of the electrical hoists installed at the same shaft. The ore hoist handles 12-ton skips in balance, raising 600 tons per hour under automatic control, and is driven by a direct-current motor rated at 2,150 hp. and with Ilgner-Ward Leonard control and Lilly safety controllers. The man-and-material hoist is designed for a rope speed of 1,550 ft. per minute when handling materials and 800 ft. per minute when handling men. A direct-current 600-hp. motor, manual control, and emergency safeguards characterize the equipment.

Development of electrical equipment and especially automatic equipment has made astonishing progress. E. L. Hough[29] states that progressive mining companies are installing automatic reclosing equipments in substations to increase the efficiency of electrical service as well as to reduce the number of manually controlled stations to a minimum. The new equipment also insures continuity of power under normal conditions and gives reliable protection to apparatus. Mistakes incident to manual operation are avoided.

Petroleum Mining Offers New Field

An extension of the field of mining operations is foreshadowed by conditions in the petroleum industry. John L. Rich[30] calls attention to the production of petroleum by mining operations. He instances European examples of mining as applied to petroleum deposits and goes into the details of the underground problem. Roy H. Marks[31] gives the results of the use of Ac-Zol in mine timber preservation experiments at the United Verde Extension company's mine and is of the opinion that this preservative is effective. W. V. De Camp agrees that Ac-Zol is suitable for underground use and gives a terse summary of the application of timber underground. D. H. Holtman states that satisfactory timber preservatives are obtainable commercially and A. B. Foote comments upon the effect of wetting timbers as a means of preservation. The requirements for successful mine operation are discussed at length by C. W. Hall[32], who gives a number of interesting details.

Late in the year appeared bulletin 235 of the Bureau of Mines on "Mine Timber," by George M. Hunt, R. R. Horner, and Harry E. Tufft. This is an excellent little handbook on the subject of selection, storage, treatment, and use of mine timber. At the Arizona meeting of the American Mining Congress, interest was taken in the subject of timber preservation. J. H. Hensley, Jr., described in detail the operation of a small-pressure treatment plant installed at the Miami mine. At the

[19] J.C.M. & M.S. of S.A., July, 1925.
[20] *Trans.*, A.I.M.E., Sept., 1925.
[21] *Mining Journal-Press*, Vol. 119, p. 1048.
[22] Serial No. 2663, U. S. Bureau of Mines.
[23] Serial No. 2671, U. S. Bureau of Mines.
[24] *Mining Journal-Press*, vol. 120, p. 569.
[25] J.C.M. & M.S. of S. A., Jan., 1925.
[26] Serial No. 2660, U. S. Bureau of Mines.
[27] *Mining Journal-Press*, Vol. 119, p. 477.
[28] *Mining Journal-Press*, Vol. 119, p. 637.
[29] *Mining Journal-Press*, Vol. 119, p. 563.
[30] *Mining Journal-Press*, Vol. 119, p. 919.
[31] *Mining Congress Journal*, March, 1925, p. 127.
[32] M. & M., Vol. 6, p. 285.

ably with sodium sulphide and polysulphide and calcium polysulphide.

In addition to xanthate and lime, other reagents and conditioning agents have come into use for accelerating or retarding the flotation of various sulphide minerals. One of these is sodium cyanide, the action of which has been described by H. E. Keyes.[9] A better understanding has come about of the injurious effects of certain inhibiting factors in flotation, such as gangue interference, colloid effect, and other similar difficulties, with the resultant use of proper remedies to overcome them. For preferential flotation of molybdenite from copper sulphide, kerosene and sulphur dioxide act as depressing agents for the copper, while allowing the molybdenum to float. Statistics of flotation oils and reagents have been compiled by the Bureau of Mines.[10] One significant item is the increase in the consumption of xanthate.

Flotation machines of the pneumatic type are employed to a much greater extent than those using mechanical agitation. One difficulty found in employing the new lime circuit is the rapid clogging of the canvas air-bottoms, and attempts are being made to avoid the use of canvas mats and still effect the distribution of the air through the pulp. The new Owen and Dalton machine, which is reported to give improved results in floating lead-zinc ore in Idaho, is made up of 10-ft. sections, with an elevating wheel at the end of each section to lift the pulp to the next section. In each section there is a rotor which produces the froth on much the same principle as the well-known K. & K. machine. For testing purposes the U. S. Bureau of Mines has in use a little machine which yields satisfactory results on samples of ore as small as 50 grams.[11]

In flotation litigation the latest development is the suit of Metals Recovery Co. against Anaconda for infringement of the organic flotation reagent patent No. 1,364,304. The question of patent interference between this patent and the application of the Minerals Separation Co. for patent on xanthate is still undecided. During the year the Wolf suits against the Minerals Separation Co. and various operating companies were dismissed. Over two years have elapsed since the filing of final briefs in the Magma suit before the U. S. District Court in Maine. This most unusual delay has brought about a most serious situation for other operators who do not know whether they are paying royalties unnecessarily or whether they are to be subjected to heavy damages for infringement during this period of waiting.

Not much advance has been made toward a satisfactory flotation theory acceptable to all, although T. M. Bains, Jr.,[12] has reported results from further electrometer tests which appear to demonstrate conclusively that electrostatic charges play an important rôle in flotation. Considerable discussion has resulted over a proposed flotation theory based on the results of X-ray analysis.[13]

No change has occurred in the apparatus for thickening and filtering flotation concentrates, but the adoption of a lime circuit has had a remarkable effect in accelerating these processes so that the number of thickeners and filters required has been correspondingly reduced. For handling wet pulp in mills, the Wilfley centrifugal sand pump has largely replaced bucket elevators. The broad field of this device is evidenced by its use to pump flotation concentrates a distance of 2,700 ft. from the Magma mill, in Arizona, to the smelter. For elevating dry ore, inclined belt conveyors are favored in place of bucket elevators. The ability of belt conveyors to transport ore over considerable distances is shown by an instance of a single conveyor over 1,500 ft. in length.

In mill design the present keynote is simplicity and economy. Less floor space is being required. Machines are driven directly by electric motors. Short-belt drives and compact speed-reducers replace long belt connections. The tendency toward simpler mills using all-flotation flow sheets has been discussed by A. W. Fahrenwald,[14] who illustrates the situation by typical flow sheets and shows how the application of more efficient classification may lead to improvement. He also advocates greater attention to the perfection of gravity concentration, and especially the elimination of gangue in coarse sizes, in order to compete with all-flotation.

Not a small part of the advance in ore dressing in recent years has been due to the aid of the microscope in enabling the operator to determine the nature of his products, especially those from flotation which were too fine for the naked eye to determine the individual minerals and their state of dissemination. For best observation polished sections are desirable, and this means briquetting. The technique of this operation has been described by R. E. Head.[15]

Credit is also due to the investigations of the Bureau of Mines on theoretical and practical ore-dressing problems at the various stations of the Bureau. One of the latest fruits of this work is the application of heavy solutions to ore testing on the same principle as the float-and-sink method for coal.

Coal preparation still lags behind ore dressing, although some improvement is made each year. Of special note are the developments in vibrating screens. dry tables, the Chance process and the Rheolaveur system, as well as the studies of the possible application of froth flotation to United States coals.

[9] *Mining Journal-Press*, Vol. 120, p. 335, 1925.
[10] Thomas Varley, U. S. Bureau of Mines Report of Investigations. Serial No. 2709, 1925.
[11] J. F. Gates and L. K. Jacobsen, *Mining Journal-Press*, Vol. 119, p. 771, 1925.
[12] *Mining Journal-Press*, Vol. 119, p. 205, 1925.
[13] *Mining Journal-Press*, Vol. 120, pp. 408, 578, 622, 739, 822, 1925.
[14] U. S. Bureau of Mines Report of Investigations, Serial No. 2694, July, 1925.
[15] *Mining Journal-Press*, Vol. 119, p. 889, 1925.

Ore Tonnages in the United States

Complete figures for ore tonnages of crude metallic ores shipped or treated in the United States in 1924, according to the U. S. Geological Survey, are not available, but the total tonnage of such ores, including miscellaneous iron, copper, lead, lead-zinc, and zinc ores, was 157,843,000 tons in 1923, as compared with 111,843,000 tons in 1922. Of the ore tonnage figures available for 1924, iron ores totaled 58,298,000 tons; copper ores in the Central States, 5,373,000 tons; lead ore in the Central States, 6,205,000 tons; lead-zinc ore in Central States, 11,493,000 tons; zinc ore in Central States, 1,639,000 tons, and in the Eastern States 1,375,000 tons. In the same year bauxite ore totaled 389,000 tons; manganiferous ores, 978,000 tons; and quicksilver ores, 70,000 tons. Copper ores in 1923, for which the statistics are complete, totaled 45,573,000 tons, of which 39,433,000 was mined in Western States; 5,363,000 tons in the Central States and 777,000 tons in the East.

together with the settled slime at each revolution. Depending on the depth of cut, the sand filter-bed requires renewal at intervals varying from a week to several months. Good work by the Gentner continuous vacuum thickeners at Trail, B. C., has led to the installation of four more machines. These machines and their work at Trail have been described by C. E. Chaffin.[5]

There is little new to report on jigs and tables. A new table by A. W. Fahrenwald is understood to be in the experimental stage. Tables continue to give way to flotation. Thus by finer crushing the Morning mill, treating lead-zinc ore in the Cœur d'Alene district, has eliminated jigs and now uses only tables and flotation. The change has increased the lead recovery 7 per cent, the silver recovery 6 per cent, the zinc recovery slightly, and the grade of the lead concentrate has been raised 9.5 per cent. The National Lead Co., in Southeast Missouri, is now trying out an all-flotation flow sheet in one section of its mill, and the results are reported to look promising.

Rotary pans still continue unexcelled in their field for treating diamondiferous earth in South Africa. This device and its possibilities are little understood by Americans and, therefore, the article by A. V. Eulich[6] covering this subject is most welcome. Amalgamation is still losing ground. It is now common practice in South Africa to employ corduroy blankets in the place of amalgamated plates. Magnetic and centrifugal processes have not advanced, but pneumatic separation in the form of dry tables is still expanding its field of usefulness on coal. The same statement is true for heavy-density separation by the Chance sand flotation process, which is now being applied to bituminous coal following its success on anthracite. Further laboratory investigation of the new process of dielectric separation has given promising results, but as far as known to me, no commercial plant has been installed.

Flotation Makes Important Advances

Flotation has now reached the point where it is found in nearly every mill treating sulphide ores. Even in the Joplin-Miami zinc district a number of mills are now equipped with a flotation division for slimes. As previously stated, the big development has been in the use of xanthate and lime circuit. All of the big copper mills have adopted this process, and the amount of frothing agent required is very small, around 0.1 lb. of xanthate and 0.2 lb. of pine oil per ton of ore. A good example of the benefit derived is the Greene Cananea mill, which treats a heavy sulphide ore containing chalcopyrite and pyrite. In 1923, with ore assaying around 1.9 per cent, copper, the extraction by combined tables and flotation was about 87 per cent of the copper, the concentration ratio being about 2.5 tons into 1, and the concentrate assaying 4.4 per cent copper, 15 per cent insoluble and 35 per cent iron. In 1925, all-flotation eliminated much of the pyrite and further improved the results so that on ore of practically the same grade as in 1923 the extraction was around 93 per cent, the concentration ratio being about 10 tons into 1, and the concentrate assaying 19 per cent copper, 7 per cent insoluble, and 29 per cent iron. Instead of over 600 tons of concentrate per day, as in 1923, the smelter in 1925 had to handle only 140 tons per day, which meant a great decrease in smelter equipment and labor, an increase in smelter extraction, and, what was most important of all, a greater tonnage of copper produced with a very marked decrease in the per-pound production cost.

The accompanying table derived from the article by A. B. Parsons[7] on the new Nevada Consolidated mill affords unmistakable evidence of the advance that has been gradually made on porphyry copper ores through flotation combined with improved mill design and simplified flow sheet. In 1908, this was a gravity concentration plant. The present mill is using a combination of tables and fine crushing. The significant points are the drop in costs and the increase in extraction. Today the mill extracts about as many pounds of copper per ton from a feed assaying 1.1 per cent copper as it did five or ten years ago from a feed assaying 1.5 per cent copper.

Data From Nevada Consolidated Mill

Year	Assay of Feed, Per Cent Copper	Extraction, Per Cent	Cost of Milling, Cents Per Ton	Tons Milled Per Man-shift
1908.....	2.3	66	.....	....
1914.....	1.5	68	.....	....
1919.....	1.6	70	107.5	15.3
1924.....	1.2	87	59.7	28.3
1925.....	1.1	91	.....	.....

It is understood that successful elimination of pyrite in other mills has caused the United Verde Copper Co. to decide to build a flotation plant for treating certain grades of ore instead of sending such ore direct to the smelter, as has been the practice heretofore.

Flotation of Complex Ores

The other important advance in differential flotation is on complex lead-zinc-iron ores, the method being now applied in numerous plants. The economic effect is to stimulate production of these ores and to lead to the reopening of old mines. With the completion of the new 1,000-ton flotation plant of the United States Smelting, Refining & Mining Co. at Midvale, the continued operation of the plant of the International Smelting Co. at Tooele and the plant of the Combined Metals Co. at Bauer, there are now three companies in Utah operating on a custom basis and bidding competitively for these ores. It is true that less than half the zinc in the ore is paid for, and at a price considerably below the market quotation; nevertheless the lead-zinc miner finds himself receiving a net return from 50 to 100 per cent greater than formerly, when his lead ore was penalized for all zinc above a certain amount (usually 10 per cent). It is estimated that in Utah alone, the tonnage of lead-zinc ores treated daily by flotation is 2,000 tons and that the resulting extra saving will amount to $3,000,000 annually. For the best summary of the plants employing differential flotation, together with details of operation and reagents employed, the reader is referred to the report of A. W. Fahrenwald.[8]

Flotation of oxide lead ores is growing, the latest report being that tests in the Ajo mill have demonstrated that the Ahumada ore of Mexico is readily amenable to this process and that a mill will be constructed. As yet the flotation of oxide copper ores is practiced only to a limited extent, owing to difficulties with a pulp containing sodium sulphide. Some work by the Bureau of Mines has indicated that barium sulphide is an efficient sulphiding agent, comparing favor-

[5] *Mining Journal-Press*, Vol. 120, p. 74, 1925.
[6] *Mining Journal-Press*, vol. 119, p. 997, 1925.
[7] *Mining Journal-Press*, Vol. 120, p. 725, 1925.
[8] U. S. Bureau of Mines, Report of Investigations, Serial 2700, 1925.

Hydrometallurgy

Electrolytic Copper and Iron—Roasting and Bulk Leaching

By A. W. Allen
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EXTENSIVE RESEARCH and experimentation during 1925 demonstrated the technical and economic efficiency of the process developed by Robert D. Pike, which is particularly applicable for the treatment of high-iron copper concentrate. Although proved originally on high-bornite concentrate from the Engels Copper Co.'s mine in California, it is equally suitable for pyrrhotite, chalcopyrite, or similar concentrate or ore. A recovery is made of the contained copper, gold, silver, sulphur, and iron. The raw material—flotation concentrate or finely ground ore—is agitated in a closed container with a hot solution of ferric chloride, after which a separation of solid from liquid is made by filtration. The solid residue is subjected to a distillation process for the recovery of the sulphur, and the filtrate is treated with sponge iron for the production of a copper-silver-gold sludge. The solution then passes to electrolytic cells for the production of cathode iron of high purity.

Another item of interest in the hydrometallurgy of copper in 1925 was the release of details of the Van Arsdale process for the treatment of mixed (oxide and sulphide) Inspiration ores. The plant, of thirteen 7,500-ton vats, is under construction. Investigations and pilot operations indicated the practicability of using a dilute sulphuric acid leach liquor carrying ferric sulphate, with the electrolytic deposition of copper and the regeneration of solvent in a non-diaphragm cell. The ore will probably be crushed to 3 mesh and extraction leaching will be applied for nine days. A new supplementary cycle of residue washing has been developed: After normal displacement an extra wash will be applied, the copper in the effluent being deposited on scrap iron, the barren liquor being re-used as a displacement wash so long as economically advisable. The product from the cementation plant will be dissolved in normal leach liquor, and the copper recovered by electrolysis. The high-iron liquor from the cementation plant will be used to maintain the proper iron content of the normal leach solutions.

Reports from Gleeson, Ariz., indicate that the fire started purposely in the Copper Belle mine is dying down, and that preliminary results from the second stage of the experiment—the leaching in place of the orebody—will soon be available. A paper on the latter phase of the subject, with particular reference to the work being done by the Ohio Copper Co., was read at the Salt Lake meeting of the Institute in September. Success in the application of the basic idea is also reported from Kimberley, Nev. Work in Western Australia, by H. R. Sleeman, indicates that a promising field may exist for the application of heap leaching to comparatively high-grade oxidized copper ore. Some novel features have been developed at Whim Well, including the more careful preparation of the ore and the adoption of a new principle in the circulation of liquor. Promising research indicates the practicability of manufacturing a desirable type of sponge iron at a low cost.

Attention was directed during 1925 to Africa as a future producer of copper on a large scale, but metallurgical information has been scanty. Union Minière, in the Belgian Congo, is apparently waiting to learn the results of the application of the modified Perkins ammonia-leaching plant recently put into operation at the Bwana M'Kubwa, in Northern Rhodesia, before deciding definitely as to what will be done with its own oxidized ores. The presence of copper and nickel in the lower pyritic portions of the recently discovered platinum reefs in the Transvaal, the extent of which promises an increased and cheaper supply of that valuable metal, will doubtless lead to interesting developments in metallurgical practice.

New Lead Process Uses Acetic Acid

The extraction of lead from carbonate ores by the use of acetic acid has been proposed by R. T. Wilder, the solvent being available as a byproduct from the distillation of wood and the manufacture of charcoal. An advantage of the process is the ability to produce one or more pigments by direct precipitation. U. C. Tainton's work in hydrometallurgy is attracting well-deserved attention. The lead-leaching plant at Kellogg operated steadily throughout 1925, and plans are under way for doubling the capacity. A 50-ton pilot plant is to be erected by the Cerro de Pasco company in Peru, in which Holt-Dern roasters will be used for the preliminary treatment of the rebellious *pacos* ores, which exist in immense quantity and carry about 8 oz. silver, in addition to lead and copper. The new metallurgical unit will also include the main features of the Tainton lead-leaching process developed at Kellogg.

Considerable interest is being taken in electrolytic zinc. Frequent announcements during 1925 heralded the expansion of operations by the Anaconda company. The Rhodesia Broken Hill company, in Africa, is erecting a plant designed along lines similar to those developed by the Electrolytic Zinc company of Australia. The Bunker Hill & Sullivan company will start the construction of the first unit of an electrolytic zinc plant in Idaho almost immediately.

A paper by H. P. Allen and William C. Madge was read at the September meeting of the Institute, in which a description was given of practice at the mill of the Standard Reduction company in Utah, where a silver-lead ore is being given a chloridizing treatment in Holt-Dern roasters and then leached with a nearly saturated solution of common salt acidified with sulphuric acid, the silver being precipitated with sponge copper and the copper and lead with detinned scrap. The ore is crushed to 10 mesh, and the furnace product is sluiced to the leaching vats, of concrete, which hold 225 tons of calcine.

The Gordon-Keith process has progressed from the

pilot-plant stage, and a small commercial unit is being erected at Salida, Colo. In view of misconceptions as to scope and technology, a review of the fundamentals will be pertinent: The solvent used is a byproduct of the destructive distillation of carbonaceous matter, a common example of which is the so-called gas-house liquor. After preliminary crushing, to 20 mesh or under, the ore is roasted at a moderate heat (600 deg. C.), at which temperature maximum solubility of zinc results. It is then ground to 100 mesh and agitated with the liquor, which contains 12 to 13 per cent of ammonium carbonate. After the separation of the residue, by counter-current decantation in closed thickeners, the solution is freed of all metals other than zinc by the addition of that metal, the resultant liquor being treated in stills with steam for the volatilization of the ammonia and excess carbon dioxide, the zinc being precipitated simultaneously as the basic carbonate. This is dried and heated to 400 deg. C., producing the oxide, ready for marketing, and carbon dioxide. The gas joins the gaseous products of the stills and goes to an absorber, which also receives the free ammonia recovered by the treatment of the ammoniacal zinc hydroxide, which results from contact of the roasted ore with the original liquor, to which lime has been added to precipitate calcium sulphate. The solid material resulting from the separation of the original pulp is heated to facilitate the recovery of ammonia and ammonium carbonate, which are volatilized and sent to the absorber. The residue is dried and is then ready for smelting treatment, for the recovery of gold, silver, and lead.

Coolbaugh Process to Extract Copper and Cadmium

The Coolbaugh process plant at Durango, Colo., was operated on a commercial scale throughout 1925, treating zinc concentrates from Telluride and Silverton. The material, which is treated in a Skinner roaster, is self-burning; and an average of as much as 82 per cent of the zinc can thereby be converted into the water-soluble sulphate. Inasmuch as the copper is also made water soluble, and as at Durango the zinc sulphate is dried and sold without further treatment, "impurities" must be kept as low as possible. It is, for this reason, not always advisable to convert the maximum amount of zinc to a water-soluble form. When the original copper content is high, the amount of zinc sulphate formed is maintained at about 60 per cent, in which case a considerable amount of zinc oxide also results from the reaction. If the roast is carried out in this manner, the zinc oxide will react with the copper sulphate and produce an insoluble copper oxide and a soluble zinc sulphate, and thus keep the zinc sulphate almost entirely free from copper. Small traces of copper can be removed by agitation with zinc dust.

A test run of several tons of a cadmium residue was made during 1925. Being low in sulphur and iron it was mixed with about an equal amount of a pyritic ore, to make a suitable blend for the production of cadmium sulphate. It was roasted without extraneous heat, whereby over 96 per cent of the cadmium was converted into soluble cadmium sulphate, for subsequent extraction by leaching. The residue proved to be a desirable lead product.

The field of application of the Coolbaugh process was broadened in 1925 by the discovery that over 90 per cent of the copper in copper ores and concentrates containing considerable amounts of iron and sulphur, when roasted by this method, will be converted into soluble copper sulphate. No external heat is required, and the cost of the operation is no more than is incurred in normal practice. The leach solution contains extremely small amounts of iron and other impurities, so that its electrolysis is an exceptionally cheap operation. As an alternative to electrolytic treatment, a high-grade cement copper can be obtained by the use of tin scrap or sponge iron. The residue can be washed with additional water, to remove traces of copper sulphate, and then cyanided for the recovery of the contained gold and silver. The consumption of cyanide, using the Mills-Crowe regeneration process, is about 1.5 lb. per ton.

Intensive study and research is indicating that many a complex metallurgical problem may be solved by the direct or indirect production of a commercial chemical compound of the metal after the leaching of the raw or roasted ore. A discussion of the scope of bulk leaching and a study of the fundamental principles involved was published in the June issue of *Chemical & Metallurgical Engineering*. At the Ashanti Goldfields property, where roasting, amalgamating, and bulk leaching was abandoned in favor of fine grinding in cyanide solution, a reversion to former practice has resulted in a considerable increase in extraction and a reduction in the cost of treatment. Roasting is a cure for many metallurgical ills, and it invariably facilitates the application for the cheapest and most efficient method of extraction—bulk leaching.

Electrolytic Precipitation in Cyaniding

What was perhaps the most significant development in cyaniding in 1925 was the successful utilization of electrolytic precipitation in consequence of the introduction by U. C. Tainton of a new process at Tonopah, Nev. Efficiency is high, no metallic contaminant is introduced into the solution, and a regeneration of nearly all the combined cyanide is secured. A feature of the result is the improved extractions being obtained by the use of the electrolyzed solutions, with a significant saving in cyanide and a lowering of residual loss. The prospects are favorable that the same system may prove applicable for the precipitation of copper. The success of this regenerative-precipitation method is due to the application of a new principle in electrometallurgy —continuous deposition of the metal and its concurrent detachment by the friction of the solution.

The question of the advisability of impoverishing normal gold-ore pulp before cyaniding is commenced has been obfuscated by the usual amount of unthinking comment. A leading engineer, in discussing a paper on Indian cyanide practice, read before the Institution, interpreted the result as indicating the displacement of "amalgam" by "blanketing." A study of facts, however, indicates that the high yield and low residue being obtained on the properties in question are due to high extraction efficiency by the amalgamation of blanket concentrate as well as of ore. Instances occur, of course, where conditions are not favorable for the application of a preliminary impoverishment process—where, for instance, the ore is refractory and must be ground extremely fine to expose the gold. This condition has apparently arisen in the Far East Witwatersrand, where a satisfactory extraction is being

secured by solution treatment alone—not, however, equal to the average extraction obtained over a period of many years in amalgamation-cyaniding plants elsewhere in the district. A local modification in practice, indicating the wisdom of abolishing amalgamation in some instances, does not justify predicting the general abolition of amalgamation of ore or concentrated product. As F. Wartenweiler and K. L. Graham state in a recent Institution bulletin: "The combined method, embracing separation of the coarser gold, followed by a dissolving treatment for the fine gold, is the one practiced in the majority of cases, and a total extraction of 97 per cent, with a residual gold content of 0.26 dwt. per ton of ore over millions of tons treated, illustrates the 'technical adequacy' of such practice."

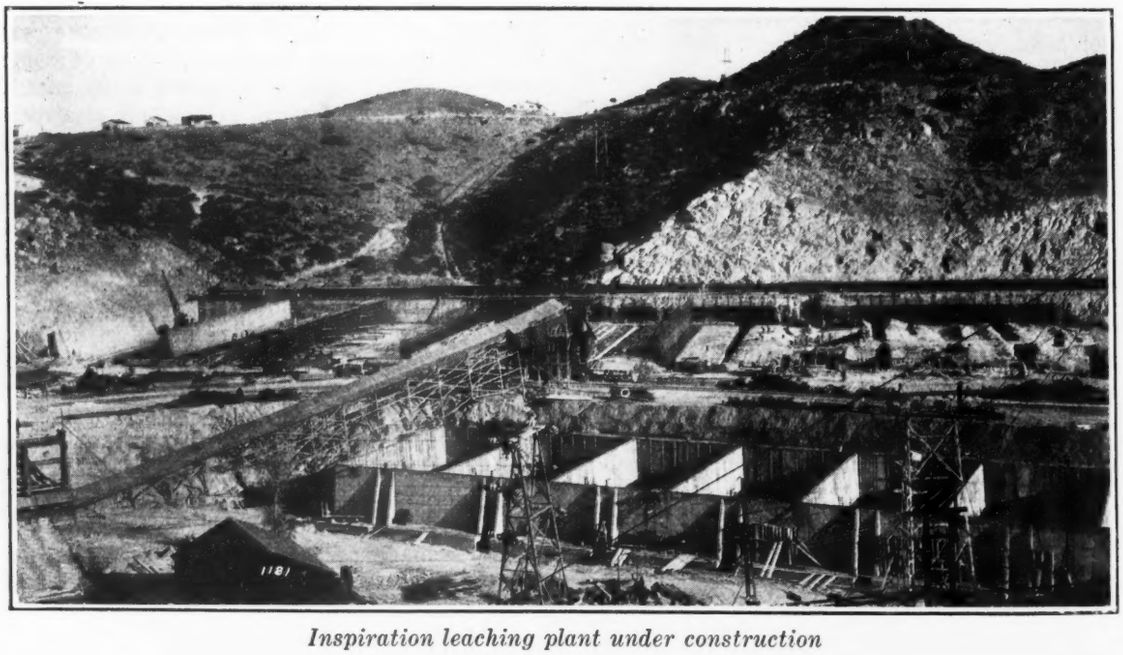
Series Filtration a Feature of Recent Cyaniding Practice

The use of the continuous vacuum filter in Canada is expanding, especially since B. D. Kelly drew attention to a logical method of application—series filtration with intermediate pulping. Hollinger, in its new addition, is reverting to the use of Pachuca agitators and adopting the Kelly system in place of counter-current decantation. Lake Shore has introduced a modification in counter-current decantation practice, with excellent results—diluting thickener underflow with aërated barren solution and agitating the resultant pulp before further thickening. Oliver filters will handle the final pulp discharge.

Wright-Hargreaves is experimenting with flotation for the isolation of tellurides, which will be bromocyanided—an innovation that has proved successful at Groya Links, Kalgoorlie, Western Australia. Porcupine Paymaster is building the first unit of a plant, in which the slimed ore will be thickened, agitated, filtered, re-pulped, and re-filtered. The McIntyre is adding American filters to impoverish further the tailing from the counter-current decantation plant. Porcupine Goldfield Development & Finance is building a new mill that will use counter-current decantation and filtration. All these developments indicate increased interest in the mechanics of residue impoverishment.

The U. S. Bureau of Mines issued in 1925 a comprehensive monograph on the treatment of manganese-silver ores, by G. H. Clevenger and M. H. Caron. The Halvorsan cyanide-regeneration process was described by E. S. Pettis in the March issue of *Mining & Metallurgy*. Paul T. Bruhl, in *Mining Journal-Press* of Aug. 8, discussed frankly the trouble experienced by the use of the so-called black cyanide in the treatment of silver ore, and proposed an effective remedy. The same authority, in collaboration with H. T. Mainell, contributed an excellent article on the operation of the Rosario mill, in Honduras.

The passage of time and absorption in the manifold intricacies of technical work make one forgetful of historical data. It was therefore with much interest that I read Bernard MacDonald's comments in the June 20 issue of *Mining Journal-Press* and his friend's suggestion that his views on the subject "would be important as the groundwork for the first chapter in the history of the adoption and use of the cyanide process in the treatment of silver ores"—referring to the work at Guanajuato, with which Mr. MacDonald was associated in 1904. As a close student of the subject, however, I am tempted to question those views. The first large and complete cyanide plant for the treatment of silver ores was, so far as I know, put in operation at Palmarejo, Chih., by T. H. Oxnam early in 1902. I took charge of it in 1907, suggested in 1908 that operations be discontinued, and carried out the preliminary research that led to the design of a more efficient unit, which, however, was never erected, because of the revolution. If "successful" may be interpreted as indicating an improvement over prior practice, then it is evident that the Palmarejo plant was the first successful as well as the first complete large cyanide plant for the treatment of silver ores, in Mexico or elsewhere in silver-producing districts.



Inspiration leaching plant under construction

Pyrometallurgy Makes Advance in Details

Closer Intergrowth of Non-Ferrous and Ferrous Metallurgy

By Edward Hodges Robie
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COMPANIES operating pyrometallurgical plants were more prosperous in 1925 than they were in 1924, and more money has been available for research and for increasing the efficiency of operations. In the short span of a year, it is too much to expect that any changes of world-wide importance will be conceived and executed, so at first thought one would say that little of interest has happened in the realm of pyrometallurgy; and yet many old processes have been improved in details, and some new thoughts have been under consideration about which little can be said until more work has been done.

Copper smelters have been chiefly interested in the outcome of the Carson patent litigation. The U. S. Circuit Court decided that the modern method of charging copper reverberatory furnaces along the side walls infringed the patents taken out by G. C. Carson, which the smelters had not previously taken seriously. Faced by the necessity of paying royalties for a process that they considered was a logical development of the art, and public property, steps were immediately taken by the legal departments of the smelters to attack the validity of the Carson patents, and by the metallurgists to change their practice so that the patents might not be infringed and yet maximum efficiency be secured. As to the legal aspect of the fight, more will be known in the coming months: suffice it to say here that the smelters believe that they have found a plant where side feeding was done antedating the Carson application by two or three years, and have also found the man who was in charge of the work, so that the troublesome patents may be declared invalid. Only one smelter, I understand, has settled with Mr. Carson, the U. S. Metals Refining Co. paying a nominal royalty for the use of his process at their Carteret, N. J., plant, this settlement apparently being an expedient on the part of Carson's attorneys to avert certain legal action in the East, which might be detrimental to their case.

Copper metallurgists, in their study of the reverberatory problem and their attempts to improve their practice, are said to have developed at least two distinct methods of charging. One is to make a sloping bottom to the furnace, extending from the skewbacks well down to the longitudinal center of the furnace, thus, in effect, doing away with side walls. This is considered to be in accord with the Siemens patent, which expired long ago. The alternative method is to charge through holes down the longitudinal center of the furnace instead of along the side walls, reserving a siliceous charge of fettling ore for feeding in the accustomed manner. It has been maintained that improved metallurgical results have been secured thus, though it would seem that dusting would be considerably more serious, a condition that recent efforts have aimed particularly at avoiding. I refer to the screw feeding of the charge through the side walls, experiments on which are continuing at the Douglas smelter of the Phelps Dodge Corporation, and to McGregor's piston feeder, which has been or is about to be tried at the neighboring smelter of the Calumet & Arizona company. The year 1926 may see some important improvements perfected at one or both of these neighboring plants.

Radical changes in reverberatory practice have not been numerous since the present type of furnace was developed, ten or fifteen years ago. Operative results have registered a distinct improvement, however, principally in fuel ratios, the practice at Cerro de Pasco perhaps being a leader in this respect. Improved draft control devices should also be mentioned, the draft now carried being markedly less, and the excess air entering the furnace much reduced over the practice of a few years ago.

A novel arrangement of waste-heat boilers has been made in the new reverberatory plant of the U. S. Metals Refining Co., at Carteret, N. J., which will be fully described in an early issue. This, incidentally, is another smelter where the reverberatory has displaced the blast furnace; still another acquisition to the reverberatory ranks is Braden, in Chile, which is installing roasters and reverberatories in its extension instead of the nodulizing kilns and blast furnaces formerly used. On the other hand, Cerro de Pasco is reported to have recently blown in two of its blast furnaces, the government having prevented the company, on account of the smoke nuisance, from using more than one reverberatory.

Converting, in common with reverberatory smelting, was influenced by the best legal practice in at least one plant during 1925. The Peirce-Smith patents for basic converting were upheld by the courts, and licenses were taken out by Magma, Mason Valley, Nichols, United Verde Extension, and Calaveras, among the companies that had not yet signed agreements. United Verde, however, chose to go back to acid converting, though possibly only temporarily, as the basic converting patents expire next December. It may be, however, that acid converting would be competitive with basic, with our present knowledge, and it will be interesting to see just what United Verde can do, from a strictly metallurgical standpoint. When basic converting was introduced it was estimated that it would save something like $5 per ton of copper over former practice.

The 13x30-ft. Peirce-Smith converter has been accepted as standard, the Mond Nickel Co. having installed one of those dimensions recently to take the place of a 10x26-ft. converter. Speaking of basic converting brings to mind a new magnesite brick that is being developed by one of the smelters; its merits, chiefly in respect to length of life, are now well established far above the old form, so it is said. Patents should be granted soon, after which it will be generally available.

Converter gas is used to make sulphuric acid at the new plant of the Mond Nickel Co. in Ontario, two units of which were installed in 1925. After being purified

and dried, the gas passes through a heat interchange to a contact mass of platinized asbestos and thence to absorption towers and shipping tanks. An oleum system is installed where further sulphur trioxide is absorbed and oleum of any desired strength is produced. The plant is working very satisfactorily. The capacity of the two units is 25,000 tons a year. The sulphuric acid plant in connection with the Garfield smelter had to be closed down during the year, through lack of a market.

In copper refining, improvements have been largely in the tank-houses, which are not in the field of this review. At the new Chrome plant, converter copper goes direct to tilting furnaces from which it is cast into anodes. A silica bottom has been adopted for both the refining and anode furnaces, superseding the more costly magnesite. Manufacturers say they have had much trouble from the alleged poor quality of wire bars in the last year or two, and the cause of the dissatisfaction is not yet altogether evident to refiners.

Little that is new can be said of straight lead smelting. Selective flotation has cut down the zinc content of some ores, but blast-furnace practice is much as it was a year ago. Little opportunity has been offered for experimentation on a large scale, as the plants have been running to capacity. The American Metal Co. is planning to start a new lead smelter at Zacatecas, as soon as a railroad spur is completed.

In refining, mention should again be made of the Harris process; the American Smelting & Refining Co. has adopted it for Perth Amboy, though some wrinkles are still to be ironed out. At Monterey, the American Metal Co. has adopted it for dezincking; at that point the necessary salt and caustic cost about twice as much as around New York, but labor is relatively cheap, these factors having a marked influence on the applicability of the process; also, the disposal of byproducts is a problem in Mexico. Much of the value in the Harris patents lies in the apparatus used, caustic not being a particularly novel reagent in lead refining. Several metallurgists have worked out modifications, small amounts of metallic sodium being used in some instances. Arsenates, stannates, and antimonates are removed in the order named, the higher metallic oxides being formed.

High prices of antimony have stimulated interest in the ores of that metal by the Selby and Midvale lead smelters. Antimony is volatilized from the softening furnaces, a part of the precipitated trioxide being made into a useful paint for ironwork, and the pentoxide being reduced to metal.

A novelty in zinc metallurgy is reported from London—the Cooley process. A rotary furnace is used, externally heated, the reduction fuel being sprayed on to the hot zinc ore about midway of the length of the tube. Substantially immediate reduction is claimed, perhaps by nascent hydrogen, the product of the kiln being zinc dust or blue powder. The first experimental furnace was a pipe made of heat-resistant alloy, 6 in. in diameter and 12 ft. long, with a capacity of about 30 lb. of charge per hour. Kerosene, to the amount of about 25 per cent of the charge, is said to have been used for reduction fuel, which would seem to be a rather expensive step of the process. A larger pipe furnace, or kiln, 18 in. in diameter and 30 ft. long, designed to handle 1,000 lb. per hour, is to be installed as soon as a place can be found for it, the London authorities, it is understood, considering it *persona non grata* in the city limits. Mr. Cooley's device is commanding respectful attention, as the retort process is far from ideal, in spite of modest improvements.

Mechanical charging of retorts finds application only at Palmerton, I believe, in this country, its advantages about offsetting its disadvantages. There, also, a briquetted charge is used in mechanical Wetherill furnaces to make zinc oxide, but the old objections to briquets still prevail. Shasta has given up its zinc oxide plant and is shipping its ores abroad. Dwight & Lloyd sintering machines have been successfully applied at Bartlesville (see No. 12 in bibliography) and by the Tulsa company at Collinsville, and additional machines were installed during 1925 for roasting and sintering zinc ores in Spain and England. Further progress has been made in increasing the ore charge to retorts, chiefly by cutting down the coal to 40 or 45 per cent, and condenser breakage is being studied and improved. Rigg has written an interesting paper on progress in zinc metallurgy (No. 16 in bibliography). The Rosita zinc plant, in the Sabinas district of Mexico, has proved successful in its use of byproduct instead of natural gas, though it has a heating value of only 560 B.t.u., compared with 1,100 for natural gas. It was successfully started with a green crew of Mexicans. The furnace is the same type as that at Henryetta, with 1,600 retorts.

Some interesting experimental work has again been done at Trail, B. C. Zinc plant residues are passed over a Dwight & Lloyd to remove sulphur and are then charged to an electric furnace, where zinc, lead, gold, and silver are fumed off. The residue is smelted in another electric furnace by the usual methods to make iron and steel of all grades. The possibilities seem large. Anaconda is said to be attempting to duplicate the results, making use of its old ferromanganese furnaces at Great Falls. Also in Tennessee, ferrous and non-ferrous metallurgy is becoming intertwined. An iron sulphide product is being made by selective flotation, which, after sintering, is shipped to steel plants. The time may well come in the not distant future when the iron content of what are now nonferrous ores will be utilized, and wide-awake metallurgists are studying the problem.

Fume precipitation continues to attract much attention, with both the Cottrell process and baghouses having their adherents. Proper gas conditioning and intelligent supervision are essentials in Cottrell work. Mohair bags have been tried out at San Luis Potosi and Chihuahua. They stand acid fume better, but are more expensive and do not filter so well. Unit baghouses, steel incased, with mechanically shaken bags, have been given some attention.

Lack of space forbids more than the mention of much other interesting work: the introduction of the Holt-Dern chloridizing roasting process in Bolivia and Peru, following the essentials of Utah practice; the straight volatilization work of the Chief Consolidated at Eureka, Utah, soon to be resumed; the salt roast and leaching process of the Vanadium Corporation at Rifle, Colo., used in the manufacture of ferrovanadium; the complex ore process used at Florence, Colo., making a matte containing the copper, gold, and silver, and fuming the lead and zinc in a reverberatory; the cleaning of refin-

ery slags at the Eastern smelters; electric smelting in Colorado; and the extended and successful experiments of the U. S. Bureau of Mines in lime burning. Also, the following bibliography of some of the more important articles that have appeared during the year will be found worthy of reference, since much that has been published has not been referred to in this brief review.

Selected Bibliography

1. "Continuous Electrothermic Furnaces for Complex Ores." T. M. Bains, Jr. *Mining Journal-Press*, Feb. 7, 1925.
2. "Smelter and Refinery of the Nichols Copper Co." E. H. Robie. *Mining Journal-Press*, Feb. 14, 1925.
3. "The Tacoma Copper Smelter and Refinery." G. J. Young. *Mining Journal-Press*, April 4, 1925.
4. "Metallurgy of Magnesium." M. Miyake and Allison Butts. *Mining Journal-Press*, May 23, 1925.
5. "Notes on Western Lead Smelters." A. B. Parsons. *Mining Journal-Press*, May 30, 1925.
6. "Oxidation of Zinc Vapor by Carbon Dioxide." B. M. O'Harra. U. S. Bureau of Mines, Technical Paper 336.
7. "Influence of Certain Solids and Gases on the Chloridization Roast." A. B. Bagdasarian. *Mining Journal-Press*, June 13, 1925.
8. "The El Paso Smelter." G. J. Young. *Mining Journal-Press*, June 27, 1925.
9. "Treatment of Manganese-Silver Ores." G. H. Clevenger and M. H. Caron. U. S. Bureau of Mines Bulletin 226.
10. "Metallurgical Treatment of Zinc-Retort Residues." B. M. O'Harra. U. S. Bureau of Mines Technical Paper 341.
11. "The Metallurgy of Aluminium and Aluminium Alloys." R. J. Anderson. Book.
12. "Sintering Zinc Ores." B. F. Buff. *Mining Journal-Press*, Aug. 8, 1925.
13. "The Tintic Standard Reduction Plant." A. B. Parsons. *Mining Journal-Press*, Aug. 22, 1925.
14. "An Outline of Mining and Metallurgical Practice in Australia." *Bulletin* Institution of Mining and Metallurgy for July.
15. "Braden Copper Co.'s Caletones Smelter." M. S. Mazany. *Mining and Metallurgy*, September, 1925.
16. "Possible Improvements in Metallurgical Practice, Relating Particularly to the Zinc Industry." Gilbert Rigg. *Bulletin* Institution of Mining and Metallurgy, October, 1925.
17. "Producing Gold and Arsenic at Jardine, Mont." E. H. Robie. *Mining Journal-Press*, Nov. 14, 1925.
18. "Cyclone Dust Collectors for Recovering Zinc Oxide." W. C. Smith. *Mining Journal-Press*, Nov. 21, 1925.
19. "The Determination of Certain Curves and Their Application to the Desilveration of Lead by the Parkes Process." G. K. Williams. *Proc.* Austr. Inst. M. & M., June, 1925.
20. "Pulverized Coal as Fuel for Copper Refining Furnaces." E. S. Bardwell and R. H. Miller. A. I. M. E. Paper No. 1479-D.
21. "Cape Copper Co.'s Works." A. S. Gill, *Mining Magazine*, September, 1925.
22. "Effect of Zinc Oxide on the Formation Temperatures of Some Ferrous Slags." H. T. Mann. A. I. M. E. Paper No. 1474-D.
23. "Application of Cottrell Process in Lead and Copper Smelting." A. L. Labbe. A. I. M. E. Paper No. 1480-D.
24. "Chloridizing Mill of the Standard Reduction Co." H. P. Allen and W. C. Madge. A. I. M. E. Paper 1481-B.
25. "Lead Smelting in Utah." B. L. Sackett, C. Bardwell, S. Jacobsen and N. H. Jensen. A. I. M. E. Paper No. 1486-D.
26. "The Chief Consolidated Volatilization Process and Mill." G. H. Wigton. A. I. M. E., Paper No. 1490-B.
27. Treating Lead Ashes in the Reverberatory Furnace." E. T. Richarz. London, *Metal Industry*, June 12, 1925.
28. "Tapping the Lead Blast Furnace." E. T. Richarz. London, *Metal Industry*, July 17, 1925.
29. "Evolution in the Preparation of Ores for Lead Blast Furnaces." D. W. Jessup. A. I. M. E. Paper No. 1483-B.
30. "The Metallurgy of Quicksilver." L. H. Duschak and C. N. Scheutte. U. S. Bureau of Mines Bulletin No. 222.

Progress in Iron and Steel Metallurgy

Trend Toward Greater Amount of High-Grade Steel

By Bradley Stoughton
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THE OFTENER one writes these yearly reviews, the more cautious one becomes as to the material included as "progress," for what appears to be progress in metallurgy at one time is within a few years proved to be impracticable. But, if one waits until some innovation has demonstrated its commercial value, it is no longer classed as "recent progress" and has lost its news value.

That 1925 was an active year in the steel industry of the United States is indicated by production exceeding the hitherto banner year of 1917. This, in turn, brings the old question: Where does all the steel scrap come from? Are steel structures torn down almost at the same rate as they are constructed? Steel production in 1925 was the largest on record, but the estimated production of pig iron was less than during at least four previous years. Obviously, there must have been a greater proportion than ever of steel scrap used in steel manufacture.

Another significant trend is the greater amount of high-grade steels and alloy steels produced. Much of this has gone into the automotive industry, which is using higher-quality steels every year, but the railroads have made a distinct step forward in using more heat-treated steels, alloy steels, and steels of higher quality generally, while notable examples have occurred of important bridges being constructed chiefly of steels of higher price and quality.

Scarcely a year goes by without some attempt being made to produce steel directly from ore—and always with the same disastrous commercial result. Yet there is a majority opinion among metallurgists that success will be achieved some day under circumstances which render the manufacture of pig iron in blast furnaces a super-costly operation, such as it is in South America, Canada, California, Africa, and other places where ore is abundant and coke is costly. Such conditions also prevail in northern Italy and in Sweden, where electric processes for the direct production of steel from ore have been in operation long enough to indicate that the experimental stage has been passed. If further commercial operations are prosecuted in Sweden, a comparison of electric processes for steel and pig iron production from almost the same ores under almost the same conditions will become available. The plant at Niagara Falls for the production of electrolytic iron tubes and similar shapes of 99.97 per cent purity was put into operation in 1925. This is the second electrolytic iron plant in the country, that of the Western Electric Co. in Illinois having been in operation for several years. The new plant is similar to the one at Grenoble, France, which has been operating more than eight years, but is on a much larger scale than any of its predecessors. There is no doubt of the superior softness, toughness, and ductility of pure iron, and recent tests of the U. S. Bureau of Standards confirm its extraordinary cold-working properties, especially for deep drawing. Its commercial value for electric and magnetic purposes, in relation to its price, as compared with other available materials, is still under discussion.

In foundry practice much interest is still shown in the centrifugal casting of iron. There are indications that this process has come to stay, but doubters still exist. It seems to be admitted that cast iron frozen under conditions of pressure has greater density and strength per unit of volume. Steel castings with better

concerned in the North, its future activities being confined largely to the mining of tin.

Alaska—Though there was a slight decline in the production of gold in Alaska in 1925, there was an increase in copper and the other metals, and a revival in the mining industry during the year, but actual results will not be fully manifest until later. Activity consisted largely in the installation of dredging equipment in the Fairbanks district; experiments of thawing frozen ground at Nome by the use of cold water in place of steam; the development of gold-quartz claims both at Willow Creek and Fairbanks; dredge operations on Candle Creek and in the vicinity of Norton Sound, and considerable prospecting in territory tributary to the Alaska Railroad. Alaska-Juneau was the largest gold producer, with about 10,000 tons of ore per day, from which a low gold content was extracted. The Kennecott Copper Co. was the largest copper producer, and operated the Kennecott, Mother Lode, and the Latouche mines. The two former produced between six and seven million pounds of copper per month, and the latter produced about one million pounds. A plant is being installed near Juneau to treat the tailings from the old Gastineau mine, which are reported to contain as much as $1.35 in gold per ton. On the whole, the mineral industry in Alaska in 1925 showed improvement over the preceding year. Influence of better mining methods and larger-scale operations have already begun to yield results at some of the mines, and further returns are to be expected in 1926, though it may be several years before all the projects now under way will be reflected in production.

Arizona—The outstanding feature of mining activity in the Arizona copper districts in 1925 was the effort to reduce costs through large-scale operations and improved efficiency in mining methods, metallurgical processes, and industrial relationship. The result of this effort will make available for exploitation large deposits of ore of lower grades than could be mined profitably heretofore. Inspiration Copper Co.'s six-million-dollar leaching plant will be available in the near future for the treatment of copper oxide ore. Miami Copper changed its caving system to one similar to Inspiration's, in which hand tramming is eliminated. Inspiration is now producing 10,000 tons of ore per day. The United Verde Mining Co. is making preparations to steam-shovel large tonnages of ores at Jerome. Old Dominion Copper Co., at Globe, is spending $140,000 in enlarging its concentrator to mine ore deposits of lower grades than heretofore have been handled. Phelps Dodge Corporation is improving its smelter at Douglas. Among the gold mines the Katherine and Tom Reid at Oatman are the most important. These mines are producing from $50,000 to $75,000 each month. The high price of silver has encouraged activity at Tombstone and vicinity, and a number of old dumps are being reworked. The sampling plant at Kingman, opened last year, has been a boon to the prospector and small operator as small lots of ore can now be tested at the plant and then combined with other lots for shipment to the smelter.

California—Production of gold from California mines was about the same in 1925 as in the previous year, although a number of smaller properties have been reopened. The center of interest was in the new exploration work in the North Star Mines, which is sufficiently encouraging to confirm the wisdom of the plan embarked upon—that is, to make further and deeper explorations. There are now four regular copper producers—Engels, Walker, Calaveras Copper, and the Island Mountain Co., which ships ore to the Tacoma smelter. The property at Bully Hill has been worked by the California Zinc Co., largely for the zinc content in the ore. The mill is treating about 300 tons per day by flotation and produces a high-grade zinc concentrate to ship to Belgium, a low-grade zinc-copper concentrate, and a copper concentrate. The last named is sold to the smelter. In minor metals California will show for 1925 increased production in tungsten, manganese, and probably quicksilver.

Colorado—Much of the work done in Colorado during the year just closed was in the line of investigation and prospecting rather than actual development and production. Old productive districts as well as many undeveloped mineralized areas throughout the state were given renewed attention. Many development plans have matured and are now in the preliminary stages of actual operation. A number of the old-established mining organizations have become interested in rehabilitation and development of various districts, it being noteworthy that each is avoiding negotiations or large-scale efforts in districts where another company has secured an operating footing, to avoid the taking of second-choice area for development. The A. S. & R. Co. confined its mining efforts to Leadville, where, jointly with the Iron-Silver Co., in the Leadville deep-mines organization, unwatering and development of the central portion of the district have advanced to production in quantity. The custom concentrating plant near Leadville, designed to separate lead and zinc from the complex ores of the district, is pratically completed. The Cripple Creek district is the scene of many new enterprises covering unexplored surface area as well as extending the old producers to greater depth, on the theory that enriched zones will be encountered, other than the good orebodies disclosed in the Portland mine at 3,000 ft. from the surface.

Idaho—The mining industry in the Coeur d'Alene district, in Idaho, is in a satisfactory condition. Much new development work is in progress, and several enterprises, notably the Coeur d'Alene Syndicate, United Metals, and Atlas, with good financial backing, promise to bring in new mines. Numerous development operations, carried on by companies financed by assessment, give equally favorable outlook for the discovery of new orebodies. These operations, together with the large payrolls of the regular producing mines, are responsible for the prosperity that prevails in the district. During the year Hecla opened a large orebody which added materially to its reserves, and the Bunker Hill orebody has been found to continue undiminished to the 18 level, thus adding to its reserves.

Michigan (Copper) — Marked efficiency and the introduction of labor-saving devices wherever possible were the important features in the Lake Superior copper country in 1925, and have resulted in relatively greater returns. Calumet & Hecla is undaunted as to future possibilities, as it has only recently installed on its 81st level a complete underground mining hoist and other equipment for the extension of its shaft to an additional depth of about 3,000 ft. on an extension of the lode. Seneca has reached the productive stage, and Copper Range, Arcadian, Mayflower, Franklin, and Cliff are continuing development work. There is no unsold metal surplus at any of the smelters in the district, the demand having absorbed production and orders on the books promising to continue this condition well into 1926. Calumet & Hecla's new reclamation plant was opened during the year and is now producing about 800,000 lb. of copper per month from its old stamp-mill tailings, at a cost of 9c. per lb. By reason of improvements in furnaces, a notable saving in smelter costs will be effected, making possible the abandonment of smaller furnaces. Steam pumps in many places are being replaced by electric pumps.

Southeast Missouri—Under the stimulus of a 7 to 10c. lead market the Flat River district was operated at maximum output in 1925. The grade of the mill rock is slowly declining, and the approximate yield is about 3 1/16 per cent in metallic lead. The use of jigs is being slowly discontinued, and most of the lead is obtained from tables and by flotation, with a recovery of 88 to 90 per cent. Considerable prospecting is going on with diamond drills, and the new Missouri Lead Co. has secured an extensive area on the eastern fringe of the lead belt. Mine La Motte, an old property, has passed into the hands of the St. Joe Lead Co., and a new deep orebody has been discovered in the southeast portion of the property, on which a shaft is being sunk. The Desloge Lead Co. completed its new shaft and added considerable equipment to the mill, especially in the way of rock breakers. The Annapolis Lead Co. was idle during 1925 by reason of the damage done by the cyclone last spring and internal litigation. The Fredericktown cobalt-nickel property remained shut down.

Southwest Missouri — The Tri-State district never enjoyed a better year than 1925, nor held more confidence for the future than it does at present. Zinc-concentrate shipments amounted to more than 800,000 tons, and zinc-lead shipments were in excess of $1,000 000 per week during the entire year. Producers are convinced of the folly of overproduction, and when prices decline there is a common movement toward curtailment, but without united or co-operative effort. No phenomenally new

properties are also being made, by the use of special heat treatments, but more especially, by the use of alloying elements.

The molding sand research conducted under the joint auspices of the American Foundrymen's Association and the National Research Council continues to afford results of practical interest. Report comes from Germany of an open-hearth steel foundry furnace which can attain temperatures above the available limit of the ordinary open-hearth furnace without roof destruction. It is said to have been in successful operation for over two years with production of hot steel on a basic hearth, so that castings of very thin sectional area can be poured. This result, like so many accomplished in the United States during recent years, is effected by better combustion conditions in the furnace. Knowledge of the sulphur absorbed by steel in the open-hearth furnace has been advanced by researches made by the School of Chemical Engineering Practice of the Massachusetts Institute of Technology. In my last review attention was called to the progress being made in ingot practice in open-hearth plants. It is fair to say that so much improvement has been made in respect to ingot defects, especially pipes and solid inclusions, that steel which was considered clean and sound ten years ago would today be sent to the scrap pile by the manufacturer.

Physical iron and steel metallurgy is represented in publications of researches of unusual importance from the laboratory of Professor K. Honda at Sendai, Japan, especially about changes occurring in the heating and cooling of pure iron and steel, on the hardness of steel, and on the equilibrium diagrams of alloy steels. From Professor Sauveur's laboratory, confirmation was made of the indications obtained by Yensen and others, through magnetic phenomena, that iron retains at atmospheric temperature a few hundredths of a per cent of impurity of carbon, even when very slowly cooled. From the same source come interesting data regarding segregation. Dr. Mathews has thrown further light on the nature of austenite and on permanent magnet steels. French and Klopsch, of the U. S. Bureau of Standards, have begun some important publications on the study and measurement of the speed of cooling of quenched steels, and related phenomena. Many other facts of theoretical and practical importance were presented at the meeting of the American Society for Steel Treating, among which is noted especially the decrease in the percentage of carbon in eutectoid steel from 0.85 per cent in the absence of silicon to only 0.65 per cent with 1 per cent of silicon. At the same meeting, emphasis was laid on the value of the dilatometric method of heat treating steel.

At the Spring meeting of the Iron & Steel Institute (England) some interesting data were presented on strain in steel, and on magnetic and electric properties of cast iron, which relate indirectly to the annealing of cast iron.

REGIONAL SUMMARIES

United States Mining Districts Prosperous

Industry Experiences Best Year Since War

By Albert H. Fay
Assistant Editor, *Mining Journal-Press*

METAL MINES are again on the front page of industry. Prices of lead, zinc, and silver have been good. The demand for copper has been steady, although a little less than plant capacity. The building industry has consumed large quantities of iron and steel at increased prices, and has drawn heavily on minerals, sand, gravel, and stone quarries. Best of all, industrial peace has reigned at mines, mills, and smelters, with full-time employment at good wages.

Reorganizations — During 1925 there were many sales and transfers of important mining property, as well as the continuation of the policy of concentrating control into large units, to reduce operating and overhead expenses in handling low-grade ores. Among the principal mergers were the Nevada Consolidated Copper Co. and the Ray Consolidated Copper Co., which also included Chino, of New Mexico; the Shattuck-Arizona Mining Co. and the Denn-Arizona Copper Co., merged to form the Shattuck-Denn Mining Corporation; the Park-Utah Consolidated Mines Co. in Utah resulted from the merger of the Park-Utah, Park City and the Ontario properties at Park City, Utah. American Metal Co. secured

Albert H. Fay

control of a number of the old mines in Summit County, Colo. Merger of the Tuolumne Copper Co. and the North Butte Mining Co., involving properties valued at approximately $15,000,000, was completed. In British Columbia, the Federal Mining & Smelting Co. acquired 55 per cent of the Silver Lead Mine and purchased the Sally Mine. The Metals Exploration Co., of New York, disposed of all its assets, including the Flin Flon Copper Co., in Manitoba, to H. P. Whitney, of New York. In Ontario, the Asbestos Corporation, Ltd., is the result of the merger of seven of the largest producers of asbestos.

The year 1925 marks the entering of American capital into the mining industry in Europe, in that W. A. Harriman & Co. obtained extensive concessions for mining of manganese in Soviet Russia and the Anaconda-Harriman interests acquired a substantial footing in Germany by the acquisition of the Giesche zinc mines in German and Polish Silesia.

Gold Dredging — In California, the gold-dredging industry is substantially in the same position as in 1924, with less ground available and about 20 dredges in operation. Dredge operations have been waning in Alaska, but an extensive plant is contemplated in the Fairbanks region under the name of the Fairbanks Exploration Co., a subsidiary of the United States Smelting, Mining & Refining Co. Over on the Yukon side, in Canada, the Guggenheim interests dismantled the last of seven dredges and sent it to the Malay Straits to be used in tin mining. This marks the passing of the Yukon Gold Co. so far as dredging operations are

added equipment to increase their milling capacity and will be larger producers in 1926. Silver mines at Gowganda and South Lorrain developed a large quantity of new ore, and these areas can make a larger production in 1926. The nickel-copper mines of the Sudbury area have profited by an increased demand for nickel for industrial purposes and are in a stronger position than since the slump following the war.

Ontario's metal output is valued at $5,000,000 per month. Gold output for 1925 will be a little short of $30,000,000. The nickel-copper industry is producing at the annual rate of $20,000,000, of which about $15,000,000 is derived from nickel, over $4,000,000 from copper, and about $1,000,000 from the platinum content. Silver mines yield nearly a million ounces a month, the value of the 1925 product being more than $7,000,000. Cobalt metal and compounds yield about $2,000,000 and lead yields a little more than $500,000. The total value of metal output for 1925 will be about $60,000,000. Non-metallic minerals bring the total up to $85,000,000, the largest total production of any year.

The producing gold mines in 1925 were, in order of value of output, Hollinger, Dome, McIntyre, Lake Shore, Wright-Hargreaves, Teck-Hughes, Vipond, West Dome Lake, Tough-Oakes Burnside, Argonaut, Night Hawk Peninsular, and Barry-Hollinger. Hollinger is far in the lead of the others, producing nearly $1,500,000 each month, or about as much gold as is produced by the ten other companies. Dome and McIntyre are the other large producers, also in the Porcupine area. The next three in order of output are in the Kirkland Lake area. The seven largest producers are operated profitably. Smaller producers were not so fortunate and required assistance from their treasuries during the year for exploration and development. Development work at the chief producing gold mines during 1925 materially increased the total ore reserves.

Interesting new developments at Porcupine are the discoveries made at the Vipond, southwest of the Hollinger, and at the Goldale, northeast of the McIntyre. Goldale is being explored at the 1,000 level from the shaft of the Newray, both properties now being operated by Coniaurum Mines, Ltd. Goldale, Newray, and Coniagas companies are all interested in the Coniaurum. A new producer was the Ankerite. Porcupine Goldfields Mining & Finance Co. developed enough ore at this property to warrant erection of a small mill. Another new producer will be the Paymaster.

At Kirkland Lake, in addition to good results at the producing mines, an important development took place at the Kirkland Lake Gold Mining Co.'s property at the west end of the line of producers. Rich ore was encountered at a depth of 1,975 ft., several hundred feet deeper than any of the other mine workings. The shaft is now being deepened. The mill will probably be put into operation again in a few months. Kirkland Lake area made a remarkable advance during 1925. Important plant additions have been made at several properties, and the daily tonnage treated is much larger than that of a year ago.

Canadian Mineral Production—Estimated for 1925

By S. J. COOK

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	1924		1925	
Metals	Quantity	Value	Quantity	Value
Gold, oz.	1,525,382	$31,532,443	1,730,000	$35,768,000
Silver, oz.	19,736,323	13,180,113	19,494,000	13,469,000
Nickel, lb.	69,536,350	19,470,178	73,150,000	24,140,000
Copper, lb.	104,457,447	13,604,538	112,526,000	15,813,000
Lead, lb.	175,485,499	14,221,345	253,964,000	23,238,000
Zinc, lb.	98,909,077	6,274,791	111,010,000	8,469,000
Other metals	.....	4,123,120	.....	4,513,000
Totals	.....	$102,406,528	.....	$125,410,000
Fuels and other non-metallics				
Coal, tons	13,638,197	$53,593,988	13,022,000	$49,024,000
Asbestos, tons	225,744	6,710,830	260,000	8,700,000
Natural gas, M. cu.ft.	14,881,336	5,708,636	15,707,000	6,309,000
Gypsum, tons	646,016	2,208,108	665,000	2,525,000
Salt, tons	207,979	1,374,780	210,000	1,300,000
Other non-metallics	.....	2,199,667	.....	2,172,000
Totals	.....	$71,796,009	.....	$70,030,000
Structural materials and clay products				
Cement	.....	$13,398,411	.....	$13,631,000
Clay products	.....	9,215,077	.....	9,857,000
Lime	.....	3,178,541	.....	3,392,000
Other materials	.....	9,588,840	.....	6,120,000
Totals	.....	$35,380,869	.....	$33,000,000
Grand total	.....	$209,583,406	.....	$228,440,000

At Larder Lake, Associated Goldfields is building a mill. Crown Reserve, its neighbor, will probably be refinanced soon. Most attention has been given to new discoveries in the Goudreau area. At present the Red Lake area, although far from the railways, is attracting several of the most venturesome prospectors and operators, and should be well explored during the coming summer.

Silver mining made good progress during the year, and, in spite of some decline in production at Cobalt, the total output is larger than in 1924. This is due to the developments in the Gowganda and South Lorrain areas. At Gowganda the Miller Lake O'Brien found excellent ore at deeper levels and the Castle-Trethewey also made good progress. A new mine has been opened at the Walsh property by a Tonopah company. These successes have renewed activity in the area.

Producers at South Lorrain are the Mining Corporation, Keeley, and Trout Lake. Canadian Lorrain has opened high-grade oreshoots and will be the next producer. Nipissing Mines recently obtained encouraging results in exploring claims in this area.

Nickel-copper mining, while not recording an output increase, shows an increase in value. This is largely the result of increased valuation put on the nickel in the matte exported, it being 18c. per pound for 1925, as compared with 15c. in 1924. The Mond Nickel Co. installed and has now in operation a sulphuric acid plant. During 1925 International Nickel acquired the mine and smelter of the British America Metal Corporation.

Manitoba Has a Gold Mine

In Manitoba, the outstanding mining events in 1925 were the development of the Kitchener gold mine, in the eastern, and the arrangements made in connection with the Flin Flon mine, in the northern area. The Kitchener mine was developed jointly by the W.A.D. Syndicate, of New York, and Anglo-Canadian Explorers, of London. The English company was developing a neighboring property in 1924. During 1925 the companies combined, and, with the aid of a gasoline-driven plant, developed a quantity of ore which is said to be of grade to warrant mill erection.

The Flin Flon is a large deposit of complex ore. The Mining Corporation some years ago acquired a two-thirds interest in it. Exploration work proved about 16,000,000 tons of ore. Recently H. P. Whitney, of New York, acquired an option on the property, and R. H. Channing, Jr., in charge of Whitney's mining interests, will conduct exhaustive metallurgical tests on the ore. It is hoped that this will eventually lead to the development of the mine and the establishment of a smelting plant in the area. The important ore values are in copper, zinc, and gold.

Trail Has Prosperous Year

Great progress was made in 1925 by the Consolidated Smelting Co. of Canada, which operates the Sullivan lead-zinc mine, the Kimberly concentrator, and the metallurgical works at Trail. It was a very prosperous year for the company, the recently enlarged plants permitting greater production and the high prices of the metals yielding a larger profit margin. The Britannia and Granby mines are the large copper producers of British Columbia. Both did fairly well, considering the price of copper. The Premier mine continues to make large profits. This is one of the remarkable discoveries of recent years. Large dividends have been paid from the mining of high-grade ore, and the property is being equipped to handle a large quantity of lower-grade at a later date. Prospecting is active in British Columbia. Lead and zinc properties have received much attention recently because of the steadily maintained high prices.

Coal mining in Canada during 1925 suffered greatly because of labor troubles. At the close of the year conditions are much improved. An important investigation of the coal industry in Nova Scotia is being carried out by a Royal Commission under the chairmanship of Sir Arthur Rae Duncan. It

rich mines were developed during 1925, although there was much drilling activity. The most important development seems to be in the sheet-ground formation at about 300 ft. depth, extending several miles west of Baxter Springs, Kan. The companies most active in this were Federal Mining & Smelting Co., Grasselli Chemical Co., Matthiessen & Hegeler Zinc Co., Eagle-Picher Lead Co., and Commerce Mining & Royalty Co. Several new mills were built, making a total of 170 now in operation.

Montana — Taking everything into consideration, the mining industry in Montana has been satisfactory to owners, operators, and employees, and from the present outlook the year 1926 holds out promise of production and new development surpassing any time since the war. The larger metal mines maintained steady production during the year. Butte & Superior produced over 4,000,000 lb. of zinc, 1,100,000 lb. of copper, andabout 200,000 oz. of silver per month. Anaconda is producing at the rate of 18,000,000 lb. of copper per month, at a cost of 9½c. per lb. It is increasing its copper refineries and wire-drawing plants at Great Falls by about 33⅓ per cent. The zinc refinery is also being enlarged to handle 20,000,000 lb. per month, against 15,000,000 at present. With the acquisition of the Giesche mines, in Germany and Poland, Anaconda will be the world's largest zinc producer. The W. A. Clark interests are becoming more active in Butte than for many years. Their operations are under the supervision of W. A. Clark, Jr. Several properties outside of Butte are also being developed by the Clark organization, and it is said to be the plan of the managers gradually to expand activities rather than sell any assets. The East Butte Copper Co., the Midwest-Butte, and the Butte-Westside maintained steady shipments. Manganese mining at Phillipsburg took on a new impetus, with furnace ore quoted at 65c. per unit. The Mohave Mining Co. is planning to erect a 300-ton cyanide plant and a 300-ton concentration and flotation mill. A number of other small mills were installed or are in process of installation with a view to saving zinc wherever it occurs.

Nevada—Mining as a whole has been quiet except in the copper-producing districts. Silver camps have retrograded and no new discoveries of special importance were made in 1925. The new gold camp of Gilbert, 30 miles west from Tonopah, has so far proved disappointing. No new large plants, outside of copper, have been constructed, although several small gold or silver cyanide plants have been built. In the Tonopah district many new incorporations were made, especially in the western section. As a whole, the silver and gold production has declined, while the lead, copper, and zinc production has increased. At Tonopah the gold production will be about 50 per cent below that of 1924.

Oregon—Since 1914 the gold- and copper-mining industry of Oregon has been at a standstill. During 1925 there was considerable activity in prospecting and attempting to develop old mines, and a movement is on foot to erect a custom smelter in the vicinity of Gold Hill. Mining and production of quicksilver, which was important at Gold Hill during the war and several years afterward, has been entirely suspended.

South Dakota—The Homestake Mining Co. at Lead, the largest operator in the Black Hills, produced in 1925 approximately $6,300,000 from 1,600,000 tons of ore. Extensive experiments were completed during the year by the U. S. Bureau of Mines at the Reno, Nev., station on the "blue ores" of the Northern Black Hills. The results obtained were so satisfactory that an experimental plant is now being installed at the State School of Mines, at Rapid City, to make a commercial test of the "blue ores." The Maywood Chemical Co. shipped twenty-seven carloads of spodumene during the year. Regular shipments were also made of feldspar and mica. A number of companies were organized further to exploit the mica deposits. The state-owned cement plant at Rapid City operated continuously and showed a good profit.

Canadian Mining Gathers Momentum

New Discoveries—Complex Sulphide Ores to Be Exploited

By Reginald E. Hore
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NOTABLE progress characterized mining in Canada during 1925. At many mines production was larger than in any previous year. Results of exploration demanded increased milling facilities at several of the producing mines. Exploration materially increased known mineral resources and strengthened belief that many more important ore deposits will be found in the present producing areas and that many new areas will become productive.

Developments in Rouyn, Quebec

Among the most interesting recent mining developments in Canada is that in the Rouyn area, Quebec. During 1924 good results were obtained in exploring the Horne copper-gold property at Rouyn by Noranda Mines, Ltd., and in 1925 further development justified the high opinion in which this property is held.

Two shafts, both in ore, have been sunk at the Horne mine. The principal development is at No. 1, a 300-ft. two-compartment shaft. The 111 ft. sunk in 1924 was in ore that averaged $44.45 per ton, solid sulphides containing 14.69 per cent copper and $6.66 gold per ton. A second orebody, B, 61 ft. in width, was encountered in a crosscut 40 ft. west of the drift on orebody A, and a third orebody, C, 45 ft. wide and averaging $20.48 per ton, was cut at 65 ft. east of the drift on A. Other important discoveries were made on the property, and it is anticipated that by the time railway facilities are provided, and the construction of a 500-ton smelter is completed, the mine will become one of the best in the Dominion.

Operations during the summer of 1925 were made possible by utilizing the river route. The work done demonstrated that a large quantity of ore is available, much of it high grade. A smelter is to be built at Osisko Lake. A railroad is now being constructed from O'Brien, on the Canadian National Railway, to the Horne mine, and the Nipissing Central Railway has applied for permission to extend its Larder Lake branch into the new mining district. The Quebec Government has cut and graded a highway from Macamic south to Rouyn City and will continue improvements until it is a first-class highway.

Progress in railroad construction made during 1925 was not so great as was expected. Important work was done on a few properties, but there was much unrest among the prospectors and other claim owners, and exploration work was not carried on as energetically as it would have been if the railway construction had been permitted.

Good results were obtained on a few properties, as at the Waite and the Amulet. At the latter several promising discoveries were made during 1925, and a large force was engaged in exploration work during the summer. At the Waite the importance of a deposit of high-grade copper-gold ore, found by Tom Montgomery in May, 1925, was recognized. The Waite-Montgomery claims were staked last winter. They lie north of the Amulet, and were taken up because of the results of exploration on the Amulet. During the summer trenches and test pits were dug and a large body of high-grade copper ore was indicated. Camps were built and a branch road cut out to the Macamic road. A drilling outfit was taken in and several vertical holes have been bored to delimit the orebody. Official statement of results is not yet available.

The Noranda, Waite, and Amulet are the notable enterprises in the Rouyn area at present. Numerous other discoveries were made. During 1926 development will increase Quebec's importance as a mining province. Gold discoveries in the area have not yet come up to expectations, but it is practically certain that there will prove to be important deposits of gold quartz and pyrite ores in northern Quebec. The discovery of important zinc-bearing deposits in the area is further indication of what may be expected to result from another year's exploration in northern Quebec.

Ontario Makes Record Output

Metal mines of Ontario made large productions in 1925, and development at several of them was unusually satisfactory. Most producing gold mines

is thought that the results of the inquiry will be beneficial, the commission having made a good impression on both the miners and the operators.

Asbestos mining is one of the most important basic industries in Quebec. Its center is Thetford. The most recent development in this field was the merger of several of the companies, a consummation that is expected to result in better marketing conditions.

Cuba

By J. C. Porter

Mining Engineer, Robins Building, Havana, Cuba

MINING activities in Cuba during 1925 were confined principally to copper, iron, manganese, and chrome. Prospecting and a small production continue in the oil fields of Bacuranao and Bejucal, in Havana Province; near Artemisa, in Pinar del Rio Province; and near Puerto Padre, in Oriente Province.

Copper — The American Metal Co., Ltd., majority stockholders of the Matahambre Copper Mines, of Pinar del Rio, maintained the property in full operation throughout the year. This deposit is a metasomatic replacement of shales by iron and copper pyrites. The orebody is irregular in outline and variable in copper content, although the management obtains a high-grade output. Adequate development work assures a comfortable reserve of proved ore in spite of the pockety condition of the deposit. Improvements in plant and methods are constantly resulting in lowering costs and permitting lower-grade ores to be utilized.

The mine continues to make shipments of crude ore and of concentrates. The crude is run-of-mine high-grade ore, which is sorted on picking belts and then shipped. This contains, after sorting, 12 to 18 per cent copper and about 1.5 oz. of silver per ton. The lower-grade ore, after concentrating, yields a concentrate containing from 20 to 24 per cent copper and about 2 oz. of silver per ton. The estimated output for the year, taken from the reports of the American Metal Co., indicates total ore and concentrates equal to 53,213 tons, yielding 23,725,647 lb. copper and 91,916 oz. silver. The last three months are estimated. At the El Cobre mines, near Santiago, equipment for copper ore leaching has been installed and preparations have been made for operation.

Iron Mining—In iron, the mines of the Bethlehem Cuban Iron Mines Co. at Daiquiri and Firmeza, on the south coast of Oriente Province and to the east of Santiago, mined, according to the Cuban Mining Bureau, 451,031 tons of hard ore during the first half of 1925, and of this amount 247,502 tons was shipped to the United States. For the entire year it is probable that these figures will be doubled. The deposit of pyrites in Santa Clara Province known as the Carlota mine, remains inactive.

Gold and Silver—Gold claims of the Holguin district are still awaiting outside capital. Attempts have been made in the past to operate some of these deposits, but without success, owing principally to the presence of arsenic, which complicates metallurgical processes, and also to the fact that ownership is greatly involved. The large gold-silver-arsenic-antimony vein of the Isle of Pines is still idle. This was prospected several years ago by diamond drills and a considerable ore tonnage found. A promising metallurgical process for ore treatment was developed, but differences among the backers of the venture prevented the initiation of operations.

Manganese—About 10 per cent of the Cuban manganese output is derived from small, intermittently worked deposits. Approximately 90 per cent is produced by the Sun Development Co., of Oriente Province. Reports show, for the first six months of the year, that 28,334 tons has been mined by the Sun company, of which 10,250 tons has been exported to the United States. The ore contains from 27 to about 48 per cent manganese, and some has been of dioxide grade. It is estimated that the last half-year output will equal that of the first six months. Most of the Sun company's ore is mined from a deposit near Bueycito, in southern Oriente Province, but a few other small deposits have contributed to the total.

Chrome—Many small chrome deposits were worked during the year, all in Oriente. There has been a good demand for chrome ore of 45 per cent chromic acid content or better, but as Cuban chrome usually contains from 36 to 42 per cent this demand could not be met; nevertheless, some activity has been shown by the mining of 11,655 metric tons and the exportation of 20,000 tons, utilizing part of the previously mined ore.

Petroleum — Oil prospecting continues. At Bacuranao, the Union Oil Co. is actively prospecting and has also produced, according to the Cuban Mining Bureau, about 4,786 bbl. (42 gal. to the barrel) of oil in the year of October, 1924, to October 1925. Bejucal is drilling several prospecting wells and reports favorable indications. The Motembo deposit of natural naphtha in Santa Clara Province is still capable of production, but is at present shut down as a result of litigation. Puerto Padre, another oil hope, has been the scene of much oil prospecting, but has yielded nothing of importance as yet.

Mining activities are considerably influenced by the Cuban sugar market. As sugar prices were very low throughout the year, that fact has resulted in great'y limiting the Cuban capital usually devoted to mining. Going properties are, of course, slightly favored by the reduced costs of 1925, but the usual prospecting and equipping of new properties has experienced curtailment.

New legislation adverse to mining is the act, now before the Cuban Congress, requiring that 75 per cent of the employees of any business must consist of Cuban citizens. Inasmuch as Cuban labor does not take to mining, all miners employed being foreigners, it was found advisible to exempt mining from the operation of this proposed law, and it is predicted that the law, if passed, will exclude mining from its provisions.

Mexican Mines Install Equipment

Fifteen or More Plant Additions Completed

By Arthur B. Parsons

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MINING in Mexico was in reality more active during 1925 than is reflected in the accompanying graph showing the production of the four most important metals. The reason is that much energy was devoted to the development and equipment of mines that recently have been idle or have been worked on only a comparatively small scale. About fifteen important construction projects were either finished during the year or were well advanced toward completion; and a number of others recently have been started.

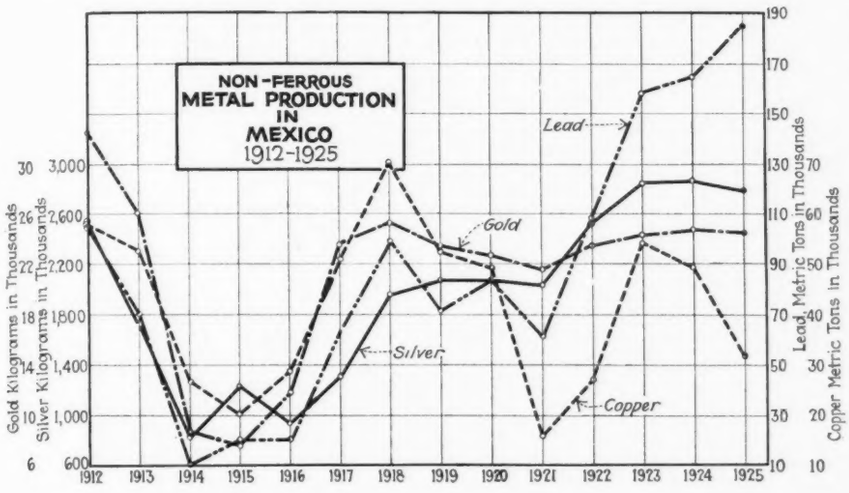
Copper production has fallen off, principally because of the curtailment at Cananea and Moctezuma in pursuance of the general policy of the larger American companies, which hope thereby to help market conditions. Another contributing factor was the virtual shutdown of the Boleo property in April and May because of labor difficulties.

Production of both gold and silver shows a small decline, which is partly attributable to the curtailment in copper production, and partly to the diminishing grade of ore in some of the mines, including those at El Oro and Guanajuato. Profits at both places are slim. In the Santa Eulalia district, in Chihuahua, El Potosi production was somewhat curtailed during the first half of the year, pending the electrification of the property and the completion of the new mill. Production at the Ojuela mines of the Peñoles company at Mapimi, in Durango, was interfered with to some extent by excessive water. On the other hand, at Pachuca, the premier silver-producing district, both the Real del Monte and Santa Gertrudis companies produced at a high rate, the former establishing a new production record in October. At Fresnillo, in Zacatecas, silver output was at maximum capacity.

A significant feature in the increased lead production is the large number of small shippers that have contributed to the total. The smelters at Torreon and Chihuahua have been working at close to maximum capacity. At Monterey the two plants have not been quite so busy, as the tributary region at present is not able to supply two competing establishments at full capacity. The good price for lead has stimulated shipments from small mines, and likewise has made profitable the shipment

of old slag dumps as well as mine and mill dumps. Production of lead from the Ahumada and Parral districts, in Chihuahua, has increased.

Reviewing briefly some of the more important development and construction projects should help give a fair picture of the substantial expansion that is taking place in the principal mining states in Mexico.



Chihuahua—At Parral, the Asarco company in 1925 finished and put in operation a new 450-ton concentrator that is now shipping lead and zinc concentrates. Work has begun on the construction of a flotation unit in the Veta Grande mill of the same company. In June, El Potosi Mining Co. finished a modern new 400-ton flotation concentrator to treat ore from its Santa Eulalia mines and its Calera property, in western Chihuahua, from which 200 tons of ore is being shipped daily. Two new baghouses and an addition to the ore bedding bins have been constructed at the A. S. & R. smelter at Chihuahua. A concentrator is planned for the Ahumada-Erupcion group, in the Los Lamentos district.

Zacatecas—At Guadaloupe the International Mining Co. is building a 600-ton sulphidizing-flotation plant to treat lead carbonate ore from the La Fé mine. A new power plant and a 50-km. railroad are part of this important project. A flotation unit has been installed in conjunction with the Fresnillo cyanide plant to treat base ores from the lower levels of the mine. At the La Noria property, 10 km. from Sombrerete, a subsidiary of the El Oro Mining & Reduction Co. is building a plant to treat 300 tons per day of silver ore, said to average $15 per ton. At the old Vetagrande property, near Zacatecas City, the Peñoles company has finished a 100-ton pilot flotation plant which is to be enlarged to handle sulphide ores; and the Pittsburgh Vetagrande Mining Co. is now completing a 600-ton cyanide plant to treat the oxidized ores from the same lodes. This company also has just installed a 1,500-hp. Diesel engine plant to supply power for its El Bote and Vetagrande units. A small lead smelter probably will be built by the Peñoles company near Zacatecas.

Aguascalientes—Minerva Mining Co. has started the construction of a 300-ton mill and flotation plant with a 700-hp. Diesel engine installation near Asientos. Silver - gold - lead - zinc sulphides from the old Minerva mine will be worked.

Jalisco—United Eastern Mining Co. is completing the erection of a cyanide plant at the El Tigre mine, at Acaponeta; and the A. S. & R. Co. is developing a lead-zinc-gold property at Ameca.

Nayarit—The United States Smelting, Refining & Mining Co. has under option at Compostela a group of old silver properties that it is actively developing.

Guerrero—At the Achotla property, the Peñoles company is preparing to build a plant in which gold-silver ore will be leached after a chloridizing roast. A 95-km. electric transmission line is now under construction. The same interests are developing the property of the Suriana Mining & Milling Co. An aërial tramway, a power-transmission line, and a 300-ton mill are projected to equip the mine. At Campo Morada, on the Balsas River, the General Development Co. is exploiting on a large scale a deposit of complex copper-silver-lead-gold ore, for the beneficiation of which a smelter probably will be necessary. A Diesel engine power plant is now being installed.

Oaxaca—The old plant at the Natividad property is being rebuilt by the Peñoles company to treat 200 tons of silver-gold ore daily by flotation and cyanidation. The mine is "80 pesos from a smelter," so that a method of obtaining bullion for shipment must be devised. Near Taviche, at the San Juan mine, a somewhat similar ore is to be treated in a new 100-ton mill now being erected by the Asarco company. A Diesel engine plant has been installed.

Puebla—The Mexican Corporation has recently completed the construction of a 150-ton plant at Teziutlan, where a complex copper-zinc-silver-iron ore is being successfully treated by selective flotation. Blast-furnace smelting was formerly practiced, but without profit.

San Luis Potosi—The American Smelting & Refining Co. completed during 1925 the construction of a new copper smelter, including blast furnaces and converters at San Luis Potosi. The arsenic plant likewise was put in operation for the first time during the year; and reports state that a lead furnace department is likely to be added to this plant. New equipment has been installed at the San Pedro and Somberete mines, near San Luis Potosi, which are operated by the A. S. & R. Co. by arrangement with the Mexican Lead Co. which owns them. At the middle of the year the Asarco company put in operation the 450-ton selective flotation plant at Charcas. Zinc concentrate goes abroad, and lead concentrate to Monterey. The United States Smelting, Refining & Mining Co. is developing a group of silver properties at Catorce. If results warrant it, a cyanide plant will be erected.

Coahuila—Early in the year the American Smelting & Refining Co. started its zinc retort and sulphuric acid plant at Rosita. This new Rosita development, including the coal mines and coke ovens, involved an expenditure of several million dollars.

The operating companies are worried somewhat by increased taxes and railroad freight rates, and by a tendency on the part of the state governments to pass legislation that unsettles the labor situation. Federal legislation respecting foreign ownership, that is interpreted as being antagonistic to the financing of mine development by outside capital, has not improved the general situation. However, the government of President Calles seems to be well established, and the possibility of revolution at this writing seems remote. This is regarded as highly reassuring by the entire mining industry.

Central America

By Charles Butters
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GUATEMALA will probably be benefited by the increased prices for zinc and lead, as zinc-lead deposits of southern Mexico have been found to extend into its territory. Future activity can be expected from this source.

Salvador — Mining is at a standstill except at Butters' Salvador Mines, where prospecting and development is in progress, the objective being the discovery of the continuation of the rich orebody worked by the company for twenty-five years.

Honduras—Although a highly mineralized area, Honduras has only one active mine, the property of the New York & Honduras Rosario Mining Co. Under an able board of directors, and the management of A. R. Gordon, supplemented by an excellent staff, this property continues to be the bright spot in mining in Central America. Nevertheless, there are lead as well as iron deposits, which eventually will attract attention.

Nicaragua — The Chontales mine, in the La Libertad district, operated throughout 1925, producing its regular quota of gold and silver. In the early part of the rainy season, a flood swamped the 600-hp. power plant,

causing a serious loss to the company. Under the management of David J. Pullinger, the active member of the board and president of the company, working costs were reduced to $6 per ton, the production being between fifty and sixty thousand tons a year. La Luz and Las Angelas, in the Bluefields section, installed a new pipe line for developing water power. The company has been a regular producer for many years. The Grecia mine, belonging to Butters' Salvador Mines, is now closed down after having been in operation for five years. It was the only silver mine in Nicaragua. Total production in silver and gold from the property was about $1,500,000. It cost about $225,000 to get into operation on a basis of 50 tons per day. The gross profit was about $375,000, from which must be deducted the capital outlay. San Albino Mines, Charles Butters' properties, are situated in the Department of Segovia, northern Nicaragua. They have been steadily under development for the last five years, and it is expected that they will be placed in operation in 1926. The nearly completed plant includes wet concentration, followed by flotation, a lead smelter and cupellation equipment being provided for the treatment of the concentrate. The completed installation will cost about $600,000.

Nicaragua is one of the most promising gold areas of all the Central American countries. The eastern part contains a number of low-grade gold-ore deposits, which need transportation facilities before they can be developed. They are a future asset.

Costa Rica — The Abangarez Mines mill from fifty to sixty thousand tons of ore per annum at a cost of $4.56 a ton. Flotation and treatment of the concentrates by cyanidation represent the methods in use. Abangarez is the only mine in Central America using flotation. Without flotation it could probably not be profitably operated. It is also an example of what will gradually take place in the treatment of gold ores and gold and silver ores. The cyanide process and the production of cyanide has probably seen its peak, and gradually, as the flotation process becomes more widely understood, and its economies are developed, its use will increase. Especially in new plants, the question as to which to install will be investigated more closely than in the past. Even in a region like South Africa, where the cyanide process is so firmly established, flotation will be gradually introduced, as its limitations are established by practice.

The Sacra Familia Mining Co., in Costa Rica, under the management of Joseph Clark, is now completing a crushing and cyanide plant, which William Hanna, the superintendent, states will be the cheapest plant yet constructed in Costa Rica.

Activity Increases in South America

Year of Prosperity—Mining Advances

Editorial Summary

SOUTH AMERICA in general had a prosperous mining year in 1925. Political upheavals — bloodless revolutions—occurred in several countries, but they appear to have been settled somehow without greatly disturbing industry. Labor agitation and advanced labor legislation disturbed the mining industry in some countries, but by compromise impracticable laws were either altered or were not enforced. The Tacna-Arica plebiscite is the cloud upon the South American horizon, and until this has been settled the new year will have the element of uncertainty.

Slightly more copper was produced in South America in 1925 than in the previous year, the estimated production being 230,835 tons, of which 133,470 tons was exported to the United States and 97,365 to Europe. Chile and Peru were the important producers, a small production being made by Colombia and probably also by Venezuela. About 5,000 tons of lead in ore and other products were exported to the United States from Chile and Peru. Chile exported to Germany 2,770 tons in the first nine months of 1925. Although several small lead smelters are said to be operated in Argentina, their production is unknown. In the first six months Argentina exported to Belgium 1,419 metric tons of lead. Bolivia exported 33,582 metric tons in 1924, but part of this was derived from old slags which are no longer available. However, certain reports indicate that Bolivia exported about 18,000 metric tons of galena ore in 1925. Peru produced both zinc and lead concentrates. South America has not exported zinc ores, but this condition may be changed by the advance of selective flotation. Peru's production of silver is estimated at 20,888,400 oz. and that of South America at 30,000,000 oz. Gold production will be between $15,000,000 and $16,000,000. The principal gold-producing countries are Colombia, Brazil, and Venezuela. Colombia produced somewhat less platinum in 1925 than in 1924, when the production was 45,000 oz. Bolivia will produce more tin in 1925 than in 1924, which production was 31,553 tons. Little or no tungsten ore was produced in 1925 by Bolivia, once a considerable exporter of this ore to the United States.

Chile exported 975,360 tons of iron ore, valued at $3,471,883, to the United States in 1925. Brazilian manganese exports have become less in amount, and Brazil's future position will depend upon the extent of competition from the Caucasus manganese deposits. Bauxite to the estimated amount of 270,000 tons was produced by British Guiana and Dutch Guiana. Chilean nitrate production was about 2,300,000 tons for the year, which was a prosperous one in the industry.

The increase in importance of South America as a potential source of petroleum is shown by the fact that production was 17,633,000 bbl. in 1923; 25,940,000 bbl. in 1924, and is estimated to have been 40,300,000 bbl. in 1925. Venezuela shows the greatest rate of increase, Peru next, and Argentina, Trinidad and Colombia showing increases in the order named. The estimated 1925 production is Venezuela, 19,000,000 bbl.; Peru, 11,000,000; Argentina, 5,000,000; Trinidad, 4,800,000; and Colombia, 500,000 bbl. The year 1926 should see interesting developments in the Lake Maracaibo region.

Colombia — The British Platinum & Gold Corporation, Ltd., operated its two dredges with more or less regularity, No. 1 dredge reporting from 200 to 500 operating hours per month and No. 2 from 17 to 107 hours per month, the output of both platinum and gold being quite irregular. Colombia Proprietary Gold Mines, Ltd., operated its dredge with fair regularity, operating time ranging from 400 to 516 hours per month and production from 60 oz. to over 300 oz. gold per month. Orville Dredging Co., Ltd., operated its two dredges most of the year. The financial position of this company has been more or less impaired by its road and river transportation investments and the disappointing returns from its Constantia mine. The South American Gold & Platinum Co. is now operating its three dredges by electric power. Frontino & Bolivia Gold Mining Co., Ltd., operated at its usual capacity, its production averaging around $40,000 per month, while that of its subsidiary, Marmajito Mines, Ltd., averaged around $8,000 per month.

Venezuela—Greater interest is being taken in gold placers in Venezuela. F. D. Pagliuchi calls attention in *Mining Journal-Press* to the gold-bearing district at the headwaters of the Cuyuni River. One company is reported to have obtained a placer concession and to be engaged in erecting a small gold dredge. Lode mining is not attracting much interest, but a small gold prospect is being developed by the Botanamo Mining Corporation in eastern Venezuela. A 200-ft. shaft has been sunk and a small amount of drifting completed. Machinery is now being installed. The South American Copper Syndicate, Ltd., operating a copper mine in the Aroa district, State of Yaracuy, reported production for several months in 1925 and very likely operated throughout the year with probably a scant profit. Interest was taken in the magnesite deposits on the Island of Margarita and reports are current that a production of 1,500 tons of magnesite per month is to be made.

The Guianas—In British Guiana less interest is now being taken in gold production, mining activity centering on diamonds, which are won by primitive methods in the Mazarumi district. The diamond-bearing area is estimated to cover 4,000 square miles, but the present workings are restricted to a number of small areas aggregating 350 square miles. Lack of transportation facilities, partly compensated for by an abundance of natural waterways, has restricted operations, but there is, nevertheless, a steady increase in diamond production from the region about the Eping and Perenong rivers. Bauxite mining greatly increased. The principal company, Demerara Bauxite, Ltd.,

is a subsidiary of the Aluminum Company of America. A concession is held in British Guiana in the Christianburg-Akyma district on the Demerara River. Some bauxite deposits have been discovered and operated in French Guiana, but much of the region in both Guianas offers opportunities for further exploration for this industrial mineral. Estimated production is around 180,000 tons for British Guiana and 90,000 tons for Dutch Guiana during 1925, an increase over that of 1924. Gold production of British Guiana is declining, and diamond production will be about the same as in 1924.

Ecuador—The South American Development Co., which operates gold-silver mines in the Zaruma district in Ecuador, continues the only mining operations of importance. Under a conservative management the property has been thoroughly developed and equipped and is now being operated upon the basis of 250 tons per day, with a gold production which exceeded 36,000 oz. in the first ten months of 1925 and a silver production of over 65,000 oz. for the same period. Although Ecuador suffered a political change during the year, that has not affected mining operations. The government is now constructing a grade for a narrow-gage railroad to extend from tidewater at Puerto Bolivar southeasterly toward the Zaruma district. Grading has been completed for a length of about 90 kilometers out of a total of 130.

Brazil—The two gold mines of Brazil, Ouro Preto and St. John del Rey, operated continuously throughout 1925, the former producing at the rate of about $50,000 and the latter at about $150,000 per month. Comparatively small amounts of manganese ore were shipped, but more or less interest is being taken in production of pig iron, and several companies are making small quantities, the aggregate production of certain blast furnaces in the State of Minas Geraes being now about 36,100 tons of pig iron annually. It is expected that this will be increased to more than 50,000 tons per annum. Wrought iron and some steel are also being produced.

Peru—Cerro de Pasco, according to estimates, produced in 1925 over 80,000,000 lb. of copper, 16,000,000 oz. of silver, and gold in excess of 50,000 oz. Only one furnace was in operation early in 1925, but later a second reverberatory was blown in, and two furnaces were operated for the remainder of the year. The Cottrell treater which was installed to overcome smelter fumes suits was started in July. By the purchase of various properties owned by individuals claiming damages from smelter fumes, the "smoke troubles" of the company appear to be at an end. With the haciendas thus taken over, it is understood that Cerro de Pasco now owns 400,000 acres of grazing land and from 30,000 to 40,000 head of stock. The work in the treatment of oxide silver ores is progressing satisfactorily. It is rumored that zinc and lead concentrates are being produced from the Casapalca district.

The Northern Peru Mining & Smelting Co., a subsidiary of the American Smelting & Refining Co., in 1925 continued the development of various properties which it had previously acquired in the Department of La Libertad, Peru. In addition, a number of other properties situated in northern Peru were exmained, and development work is now being carried upon one of these known as "Chilete." This property is located near the railroad station of Chilete, about 100 kilometers from the port of Pacasmayo, Peru.

In the Milluachaqui district the operation of the La Guardia and Diana Mines was continued, and a mill unit for each property was operated successfully during the year. In the

Guggenheim mill, in Bolivia

Quiruvilca district, development upon the Quiruvilca mine and adjoining properties was continued and development started on an anthracite mine which will supply fuel for the new pyritic smelter at Shorey. The construction of this smelter, together with the aërial tramway system to connect the coal mine, the Quiruvilca mine, and the smelter to the present Milluachaqui tramway, was continued during the year.

The rainy season of the year in Peru was one of unprecedented severity. Torrential downpours and cloudbursts were of daily occurrence during March and April in the districts in which the Northern Peru Mining & Smelting Co. was operating, and caused delay to both operating and construction work. Entire sections of roads were washed out, and transmission lines, power ditches, and other appurtenances suffered to a great extent.

Chile—The Chile Copper Co., Anaconda's subsidiary, produced slightly more copper in 1925 than in 1924, but its production is not as yet up to the total plant capacity. Operating conditions during the year were good. Various labor laws, which were passed during the previous year and which provided for old-age pensions, liability insurance, bonuses, and other advanced ideas, were revised during 1925 to bring them into practical form. These imposed certain additional burdens on all industry in Chile.

The construction program initiated in 1923 was practically completed during 1925. This program provided for the "rounding out" of the plant so as to assure an annual capacity of 240,000,000 lb. of copper. Early in 1925, additional plant extensions were decided upon. These extensions will increase the capacity to 350,000,000 lb. annually. Construction work under this latter program has been carried on, and it is expected that the new equipment will be ready for operation in the early part of 1927. New railroads between the mine and crushing plant are also being constructed. It is interesting to note that the new power shovels are to be equipped with Ward-Leonard control for direct-current operation. The original electric shovels were equipped with alternating-current machinery. In 1923, three Ward-Leonard shovels were purchased, and it is on the basis of the electrical characteristics of these shovels that the change has been made. In addition, six 70-ton electric locomotives for combined third-rail and storage-battery operation have been purchased for haulage on the mine benches and between the mine and the plant. This is the first step in the eventual replacement of the existing steam locomotives. Two 60-in. gyratory crushers will be installed in the new crushing plant. This is a change from the installation in the existing plant, which contains jaw crushers. Vertical shaft symons disk crushers will be used instead of horizontal shaft disk crushers for the first stage of the fine crushing. In other respects, there will be few changes, either in the type of the equipment or the existing metallurgical practice.

A liquid-oxygen plant is being put in, and it is expected that high explosives will be, to a great extent, replaced by liquid-oxygen explosives. Churn drills are largely used in the open-cut mining, 8-in. diameter holes being drilled in solid formation and 6-in. holes in shattered ground. These latter are sprung and are blasted with low-grade explosives. Dog tunnels are used to relieve the burden on the drill holes where the toe may be excessive, and the old form of tunnel blasting is sometimes adhered to where previously existing tunnels are still available. These changes, with the subdivision of the benches to reduce their height, represent the principal improvements in mining methods that have recently been effected.

The Andes Copper Mining Co., a subsidiary of Anaconda, is engaged upon a construction program at Potrerillos. A metallurgical plant is being built and preparations for opening the mine are under way, about 5,000 men being employed. It is expected that operation on a production basis will take place in the early part of 1927.

The Braden Copper Co. had another good year and will make about the same production in 1925 as was made in 1924. No noteworthy changes in technic or in equipment were made during the year. The company mined 4,223,856 tons of ore, averaging 2.34 per cent copper, in 1924. In the same year 257,237 tons of concentrates were nodulized and 313,422 tons of concentrates smelted. The raw concentrates averaged 18.56 per cent copper.

Bolivia

By C. Leonard Ball

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ONE OF the most important features in Bolivian mining activities during 1925 was the excellent results obtained by the Guggenheim mill at Caracoles. The mill is producing over 11,000 quintals[1] of 63 per cent tin "barilla" (concentrates) monthly, obtaining an 85 per cent extraction from a 5 per cent tin ore. This is an important event in tin mining in Bolivia, when it is considered that in Potosi and many other camps the tin recovery does not usually exceed 50 per cent. Though the mine at Caracoles is not as good as was expected, development work continues to expose more ore.

Since the consolidation of the Patiño mine La Salvadora, at Unica, with the Llallagua, A. G. Dibbs has been appointed general manager, and Joseph Insley has been named resident manager at Llallagua. The Animas mine, of Cie. Aramayo de Mines, continues producing conservatively and building up its already large reserves of tin-silver ore. The Oploca company has been operating its new mill since July, 1924. This mill is producing from 2,800 to 3,000 metric quintals of 60 per cent barilla monthly. The old plant continues to produce about 640 metric quintals of 60 per cent barilla monthly and the new plant is making practically an 80 per cent recovery from a 5 per cent tin ore.

El Salvador has been forced to close down. The mine contains a large tonnage of low-grade tin-zinc-lead-silver ore. Metallurgical problems proved to be more difficult than was anticipated, and after constructing a mill that was unsuited to the conditions, the company was not in a position financially to carry on metallurgical research and to build a new plant. In Oruro the combined production of Morococala, Huanuni, Itos and Colorado, San José, and Avicaya will amount to about 3,000 metric tons of fine tin for the year. The combined production of Araca, Chacaltaya and Carolina de Caracoles will amount to about 6,500 quintals of barilla monthly, averaging from 60 to 64 per cent tin.

Production of tin for 1925 should be considerably in excess of that of 1924. Production from the Department of Potosi will be about three times the combined production of the rest of the republic.

The Guggenheims are preparing to operate the Arafilia tin placers, near Potosi. This will be a new feature in tin mining in Bolivia, and it is probable that a considerable increase in production will result.

Huanchaca is again slowly recovering from the effects of mismanagement. The present general manager, O. Alyea, is doing excellent work in the reorganization and is getting out approximately 140,000 oz. of silver per month.

The United, the only company now operating in Corocoro, is reported to be about to suspend operations, having ceased to earn profits. Investigation by a government commission showed that neglect to carry on sufficient development work is largely responsible for the difficulties. It is probable that the Bolivian government will assist the company in its present crisis to the extent of reducing taxation, with the understanding that the company will prosecute development work as rapidly as possible with a view to placing the mine in condition for more economic operation on a scale commensurate with the ore developed.

[1]A quintal is 100 kilograms (metric system).

Union of South Africa and Rhodesia

Improved Rock Drilling—Deep Mining on Rand

By Owen Letcher

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CONTRACTION in revenue and profit earnings of the mines of the Witwatersrand occurred in 1925. For the first nine months of the year the Rand milled 21,262,618 tons of ore, yielding 7,018,524 oz. of gold, a working revenue of £29,662,423, and a working profit of £9,323,814. These figures compare with the following representing the total for 1924: Tons milled, 28,109,073; output, 9,352,396 oz.; revenue, £42,112,992, and working profit, £14,504,836.

The value of mineral production for 1924 in the Union of South Africa was £57,786,000, of which the details are given in the accompanying table.

Mineral Products—1924

	Value
Gold—9,575,101 oz.	*£40,672,447 †44,500,365
Diamonds — 2,443,347 metric carats	8,029,466
Coal—12,490,493 tons	3,830,163
Copper ore and concentrates—9,954 tons	511,844
Tin (including concentrates) 2,049 tons	304,108
Silver—1,399,626 oz.	212,602
Osmiridium—4,107 oz.	102,886
Other minerals (asbestos, corundum, lead, mica)	294,790
Total value	£57,786,000

*Standard gold price.
†Includes gold premium.

For the first nine months of 1925 the value of the mineral production was £40,643,930, according to the government reports, in which gold is taken at standard value. The individual mineral products are given in the accompanying table.

Mineral Products—First Nine Months, 1925

	Value
Gold—7,209,903 oz.	£30,625,722
Silver—906,132 oz.	129,873
Osmiridium—4,682 fine oz.	127,534
Diamonds — 1,801,527 metric carats	6,037,965
Coal (sales) 9,728,131 tons	2,922,127
Copper ore and concentrates—7,964 tons	393,140
Tin (concentrates and metallic)—1,330 tons	197,921
Other minerals	209,648
Total	£40,643,930

The gold-mining industry of the Witwatersrand continued in 1925 to produce more than half the gold output of the world. The loss of the premium on gold, the acute shortage of native labor prevailing at the moment of writing, and the constant endeavors of the labor wing of the "Pact" Government to raise the wages of employees and to embarrass the industry in various ways conspired to make 1925 by no means an easy year for the managers of the industry. That the scale of operations has been maintained on an average crushing basis of two and a third million tons per month and an average monthly output of 779,000 oz. of gold constitutes a great tribute to the tact and ability of the administrators of the "big groups" and of the much-reviled but nevertheless essential Chamber of Mines.

Technical Improvements Noteworthy

From a technical point of view the outstanding events of the year on the Witwatersrand were: continued improvement in jackhammer drilling efficiency; continuance of ultra deep development work on the Central Rand, and the installation of a plant embodying the latest ideas in what is called the new metallurgy, best exemplified at New State Areas and West Springs by the Modderfontein East, Ltd. Drilling machine performance as high as 7½ fathoms per shift has been secured, and, under the constant attention that is being devoted to this factor by the managements and also by the Ingersoll-Rand Co. and other rock-drill manufacturers, still better results are to be expected.

Both the Village Deep and City Deep companies have penetrated to a vertical depth of 7,000 ft., and, provided the grade of ore is maintained and there is no material increase in working costs, sinking to still greater depths will be undertaken. The question of what maximum depth will eventually be reached on the Rand has recently been discussed in the *Mining and Industrial Magazine of Southern Africa* by P. M. Anderson, E. G. Izod, H. F. Marriott, and others, all of whom agree that the problem is an economic rather than a technical one and concur in the view that although earth pressure at these great depths gives cause for some anxiety, engineers and mining staffs will overcome these difficulties provided the gold is there in payable quantities.

The Modder East's new "one-pulp product" installation includes a secondary crushing plant consisting of Hummer screens and disk crushers. It is designed to facilitate the recovery, from an all-slimed pulp, of the osmiridium content of the Far East Rand ores, but in one or two other respects it will differ from the two similar plants recently installed at the New State and West Springs mines.

Platinum Discovery at Lydenburg

The outstanding event in the mineral industry of the Union of South Africa during the last year has been the dis-

covery of platinum in place in the Lydenburg, Potgietersrust, and other districts of the Transvaal. It will be recalled that platinum metals were found in a brecciated felsite formation in the Waterberg district in 1923. Subsequently platinum was identified in the northern portion of the Lydenburg district in alluvials and afterward in norite formations in August, 1924. Further discoveries of a remarkably rich character were later made in hortonolite dunite on the farm Onverwacht, and these finds initiated a period of prospecting and development which resulted in the location of the platinum-bearing formation over a belt of country extending for about 60 miles from Dullstroom nearly to the Olifants River. Almost simultaneously platinum was found in the Potgietersrust and Rustenberg districts, and many companies and syndicates were formed to exploit the occurrences. In several instances the public rather than the dunite and the norite was the objective of the exploitation — and Johannesburg very soon found itself in the throes of a stock-exchange boom such as had not convulsed the public of South Africa for many years. At the moment of writing the platinum share market is decidedly dull. The pace has been made far too hot. London is still very skeptical as to the future of many of the platinum companies, and there are rumors as to difficulties of ore treatment (particularly in regard to the Waterberg ores) and anxieties as to the future price of the metal. There is no doubt, however, that the Transvaal will become a platinum-producing country in the near future—according to the government mining engineer, platinum will take rank after gold, diamonds, and coal.

Diamond Industry Restricts Product

The diamond industry presented no sensational developments during 1925. The big producers, such as De Beers, the Premier, Jagersfontein, and the Consolidated Diamond Mines of South West Africa, have had to restrict their outputs according to the quotas allotted them under the marketing agreement. The increasing areas from which diamonds are being won in Angola and the Congo, in conjunction with larger production from the alluvial diggings in the Union and from countries outside the African continent, such as British Guiana, tend to raise some doubts as to the ability of the producers in British South Africa, working in co-operation with the Diamond Syndicate, to control the price as they have done hitherto. In consequence the gem-producing industry in the Union has not expanded.

Coal mining has pursued the even tenor of its way. Industrial progress in South Africa is not rapid, and the collieries of the Union are not experiencing any material increase in the demand by home markets; and the export and bunkering trades, particularly in Natal, have been obstructed by shortage of cars, general trade depression, and the influence of European price cutting and competition.

There is little to report about other metals and minerals. Tin and copper outputs have been more or less maintained, and the present high price of tin should foreshadow some expansion of tin mining, particularly in South West Africa, where several mines in the Omaruru district are opening up in a most encouraging manner. Asbestos production is on the increase in the Eastern Transvaal, where extensive deposits of high-grade chrysotile are being worked. It is important to note that in 1926 South Africa will begin the production of pig iron at Newcastle, in the Natal, hematite ores being obtained in the Dundee district.

In southern Rhodesia the mineral output for the first eight months of 1925 was valued at £2,700,942, as compared with £4,478,499 for the whole of 1924. For the period January to August, 1925, inclusive, the value of mineral production was: gold, £1,700,692; coal, £207,-895; asbestos, £458,927; chrome iron ore, £193,855.

The outstanding features in this region have been the continued exploitation of high-grade ore in the lower levels of the Cam and Motor mine, the discovery of platinum near Makwiro and at other places along the zone of the great dike, the growth of the mica industry in the Lomangundi district, and the maintenance of the chrome and the asbestos outputs.

Copper Mining Beginning in Rhodesia

In northern Rhodesia the foundation stones of an important branch of the base-metal industry are being laid, and it seems probable that the northern part of this country will before long become the most important copper-producing territory in the British Empire. The Bwana M'Kubwa Copper Mining Co. is equipping its property, which lies a few miles to the south of the Congo border, with a plant designed by the Minerals Separation-Metals Production. The first unit will have a capacity of 1,000 tons per day. The mine is being prepared for operation by open-cut benches to a depth of 250 ft. and is employing steam shovels, the first machines of the kind to be installed in British South Africa. The Western Wheeled Scraper Co. has supplied dump cars to this company.

The Rhodesian Congo Border Concessions Syndicate, with which Preston K. Horner and Chester Beatty have been prominently identified, is exploring an extensive cupriferous country in which new discoveries have been reported. A new copper discovery known as the M'Tego is being opened up by the Rhodesian Goldfields Development Co., and at Broken Hill the new hydro-electric plant for the treatment of zinc ores has been completed.

The Anglo-American Corporation, which is extending its sphere of mining activities in Africa, has recently assumed the technical control of the Bwana M'Kubwa, Rhodesian Congo Border Concessions Syndicate, and Rhodesian Broken Hill, and under the ægis of this influential organization a marked expansion of the mining in northern Rhodesia is to be expected.

Belgian Congo's Mineral Production Increases

Total Value of Mine Products About $37,000,000

By Sydney H. Ball
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IN 1925, the fortieth year since the foundation of the Congo Free State, mining in the Belgian Congo advanced, but its impetus was curbed by inadequate railroad facilities in the Lower Congo, affecting the Central African diamond mines and the gold placers in the northeast part of the colony. The colony's approximate mineral production in 1925, estimating from records which cover only the first half of the year, was: Copper, 90,000 metric tons; diamonds (including Angola production) worth $6,500,000; gold, about 3,700 kilos (118,956 oz.); considerable radium; cassiterite, about 1,500 tons; and 80,000 tons of coal. These products have a total value of about $37,000,000, an increase in value of production over 1924 of about 10 per cent.

In 1925, the Belgian Congo was first as a world producer of radium; second as to diamonds and cobalt; third as to copper, and about twelfth as to gold. That colonial enterprises are doing well is shown by the fact that there was in 1924 a return of about 10 per cent on the aggregate capital of these companies, amounting to approximately 1,000,000,000 francs, although the stock market valuation was considerably higher. The stock which the colony holds in these enterprises considerably exceeds its debt. On Jan. 1, 1925, there were 11,539 whites in the colony, of whom 6,857 were Belgians. Of the male population, about 15 per cent were engaged in mining.

Congo, like other African colonies, needs better transportation, and of the $50,000,000 derived from the Belgian bonds floated in the United States in June, approximately one-half was to be advanced for the construction or improvement of public works. The narrow-gage railroad between the seaport Matadi and Kinchasa, the river port of all the Congo hinterland, is wholly inadequate for the rapidly increasing freight tonnages which the rich hinterland produces, and which it needs from Europe. In consequence there has been, during much of the year, a freight embargo against all but the most necessary freight. This embarrassed mining companies seriously, particularly the Central African diamond mines and the colonial gold mines. Strenuous efforts are increasing the capacity of the road, but adequate relief will be attained only several years hence upon completion of a broad-gage railroad now under construction, between these two points.

Three important railroads which in

(96,460 oz.) was blocked out, the gravel averaging 2.9 gm. per cubic meter ($1.43 per cubic yard). In 1924, 42 kilos (1,350 oz.) was produced, and judging from the yield for the first four months of 1925, the production for that year was probably about 120 kilos (3,858 oz.) Approximately 20 whites and 600 blacks were employed in the operating labor force in 1924.

During 1925 Intertropical-Comfina took out mining claims amounting to 386 square miles in the northeast part of the Belgian Congo, and Belgika, an old-established commercial company, is expected to take out mining claims in that region in the near future. Compagnie Commerciale will prospect in the Lomami region.

Coal production in the Belgian Congo in 1925 probably somewhat surpassed that of 1924 (80,000 tons). The larger part was from the Luena mines, but some was from the Greinerville mines. Two companies produce portland cement for local use. The Ciments du Congo reports a small profit for 1924. The Ciments du Katanga in October increased its capital from 10,000,000 to 12,000,000 francs.

Australasia

Gold Output Diminishes—Broken Hill Maintains Importance

By Peter G. Tait

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AUSTRALIAN gold output in 1924 was 678,062 oz. fine, but the indications are that the 1925 yield will be at least 100,000 oz. below last year's figures. The New Zealand gold yield for 1924 was 124,976 oz., and likewise a lower output will probably be recorded in 1925.

The closing down of the Mount Morgan company has seriously affected gold output, but losses in production have been contributed also by the inability of some of the old-time consistent gold areas, such as Gympie, Charters Towers, Bendigo, Daylesford, and Kalgoorlie, to withstand high costs of production. On the other hand, it is encouraging to note the number of new gold-mining companies being formed in Australia and New Zealand. Many of the famous producing mines have been worked out, but there are still extensive auriferous areas, which will be developed sooner or later.

One of the most promising ventures is the Wiluna mine, in Western Australia. This property was taken up by a syndicate of Kalgoorlie men, and, as a result of exploratory work, arrangements were made to finance a company in London with a capital of £800,000 to develop and equip the property. The Western Australian government has undertaken to connect the district by a railway. Another enterprise which is attracting interest is the Kawarau dredging project in New Zealand. A large dam is under construction to hold back the water in the Kawarau River and allow the bed of the river to be worked. Enormous quantities of gold have been recovered in the past from terraces on the river banks. With the facilities used during the earlier boom period, it was impossible to work the river bed. In the opinion of the promoters, millions of pounds' worth of gold will be recovered. Whether their anticipations will be realized remains to be seen. Another interesting New Zealand venture is the proposal to work the deep leads of Central Otago, at St. Bathans. A placer mine manager is in charge of operations and is sinking a shaft to the lead. If successful, quite a revival in that district will result.

Another encouragement to gold mining is the proposal recently made to the Commonwealth government for a bonus of £1 per ounce on new gold. Although

Peter G. Tait

the suggestion may not be sound economics, the same may be said of other artificially protected industries. In the high-protection policy now ruling in Australia, other industries receive considerable encouragement from the Commonwealth government, and there seems to be no good reason why gold mining, which has done so much for the country in the past, should not receive its share, especially as it is clear that, if some encouragement is not given, the industry will become of less and less importance. Mining promotes settlement, creates freight for railways, and gives a market for producers and manufacturers.

The practicability of applying the flotation process to gold ores continues to attract attention. A pilot plant at Kalgoorlie, under A. S. Winter, research metallurgist, is testing ore from Wiluna, and it is stated that the tests have proved that the process can treat the ore successfully and economically.

Tanami, in the "dead heart" of Australia, is attracting further attention, and the Tanami Gold Mines, of Sydney, has a plant en route. Dr. H. I. Jensen, geologist, expressed a favorable opinion on the prospects, but lack of transportation, long distance from a base, climatic conditions, and the necessity of inducing labor to settle there are stumbling blocks.

Lead, with which is associated silver, and zinc are Australia's principal base metals, and Broken Hill is today the most important mining center of the continent. Although forty years have elapsed since the Broken Hill Proprietary Co. issued its first report, the field is still "going strong," and the high prices ruling during the year have enabled the companies to earn large profits. All the ore from the Broken Hill mines is smelted at the Broken Hill Associated Smelters, at Port Pirie. This is a co-operative concern, and no figures of production are published, but the annual output is approximately 150,000 tons of lead and 7,000,000 oz. of silver. Zinc concentrates produced by the Broken Hill mines are roasted at various plants and the calcines are then shipped to the Electrolytic Zinc Co. at Risdon, Tasmania.

Next to Broken Hill, the field which is attracting most attention is Mount Isa, out from Cloncurry, North Queensland. Most of the leases were held by two companies, the Mount Isa Mines, Ltd., and the Mount Isa Proprietary, but, according to a recent announcement, the former company is acquiring the leases held by the latter. The field is still in the development stage, but it is claimed that large tonnages have been proved, and this is substantiated by the reports of the government geologist. An important decision was reached recently by the Queensland Parliament, which decided to construct a railway line 60 miles in length from Duchess, on the Cloncurry system, to the Mount Isa field, at a cost of £450,000. The mining companies have agreed to contribute £13,000 per annum for ten years toward liquidating the estimated loss in railroad operation. An agreement entered into early in 1924 with a firm of London financiers provided that Mount Isa Mines, having expended £100,000 in development work from Jan. 1, 1924, the financiers, if expert opinion justified the erection of a plant and other facilities, would advance up to £500,000, as required.

Tasmania is also a producer of silver-lead ore, such mines as the Magnet, North Mount Farrell, and Round Hill making regular shipments, although on a small scale as compared with Broken Hill. The Zeehan district production is mostly from tributers. The South Comet mine, near Zeehan, is being equipped with a plant and will soon be in operation. It is surprising that, with the high prices ruling for metals, there has not been more activity in the Tasmanian silver-lead districts.

Northampton district, in Western Australia, is still producing. The Surprise is the principal mine, but other mines are also in the list of productive properties. Recently, Sydney and Adelaide investors have taken options on various properties, and their engineers have been visiting the district. Apart from the Broken Hill output, practically all the silver-lead ores are sent to Europe.

About tin mining there is little requiring special comment. Such mines as Mount Bischoff, Briseis, and Pioneer (all in Tasmania) continue, although

four or five years will solve the transport difficulty made normal progress in 1925—the Lobito Bay-Katanga, the Lower Congo-Katanga, an all-Congo outlet for Katanga copper, and the French Congo railroad from Pointe Noire to Brazzaville. The Aketi-Djamba light railroad around the falls of the Itimbiri River was finished on Feb. 25, 1925. River transport is being continuously improved, and the mileage of motor roads is being increased. Wireless communication has been bettered.

The Union Minière du Haut-Katanga, in southeastern Belgian Congo, produced somewhat over 90,000 metric tons of copper in 1925, an increase over the 1924 production of over 5 per cent. The increase was scarcely as great as had been expected, owing to the congestion of the ports, Beira and Dar-es-Salaam, at different times, and also to a shortage of native labor. The copper-field freight can eventually use advantageously not only its present railroads but the Lower Congo-Katanga and the Benguella lines as well.

The increasing importance of the company, particularly during the last year, has drawn the attention of the copper world to its operations. The mines operated were the Kambove, Likasi, Star, Ruashi, and Kalabi, the last-named having been brought into operation in 1924. The Kipushi mine, 7 miles from the Lubumbashi smelter, should be in production by now. In 1924, 1,564,958 tons of ore was mined as well as 283,924 tons of limestone and iron-ore flux. On Jan. 1, 1925, the reserves were 74,686,600 tons of ore, averaging 6.69 per cent copper, equivalent to 4,998,000 tons of metal. The staff numbers 1,350, and 14,000 blacks are employed, 50 per cent being Rhodesian natives.

The greater part of the 1925 production was obtained by direct smelting of high-grade ore and rich concentrates. The experimental reverberatory furnace furnished its quota, and the pilot leaching plant also produced some electrolytic copper. The Panda mill produces both a coarse and a fine concentrate containing between 23 and 24 per cent copper, and the tailings (3 to 7 per cent copper) are to be either floated or leached. Screening and washing plants are operated at the Star and Likasi mines. In 1924 most of the copper was shipped via Beira, but about one-tenth went out of the colony by Dar-es-Salaam. Over one-half of the production is refined by American refineries, and the rest by the Nord Deutscher Affinerie, at Hamburg, and La Société Hydro-electrique et Métallurgique de Palais, in France.

In February, 1925, new securities were issued, netting the company about $7,500,000. This money will be used in erecting leaching works consisting of three units, each of 30,000 tons capacity, and one reverberatory furnace plant, also of 30,000 tons (copper in tons per annum). Work was started on these in 1925. To generate hydro-electric power at Lufira Falls to run these works the Société Générale des Forces Hydro-electriques du Katanga (capital 75,000,000 francs) was formed in November. The capital interested is closely allied to that in the Union Minière. In 1924, the Union Minière paid a dividend of 150 francs per share (138 francs free of income tax.)

Mixed intimately with the oxidized copper ores, particularly of the Luushia and Ruashi mines, is a black hydroxide of cobalt. An electric furnace at Panda (initial capacity 150 tons per month) smelts this to an iron-copper-cobalt alloy, and this is treated in a wet process plant at Oolen, Belgium. The latter plant, owned by the Société Générale Métallurgique de Hoboken, was started up on June 22, 1925. It produces metal and cobalt sulphate and oxide. The number of its products is to be increased, and use of cobalt in steel alloys will be fostered. The company apparently is in a position to at least become a very important factor in the cobalt trade.

The rich uranium Chinkolobwe mine of the Union Minière furnishes the ore which has permitted Belgium, since 1923, to control the world's radium supply. In 1925 important new discoveries of uranium ore were made, and further decreases in the price of radium are possible. To the end of 1924 the company had sold a total of 35 grains of radium.

The shares of Tanganyika Concessions, which holds a substantial interest in Union Minière, during 1925 advanced decidedly in the stock market, due in part, it is said, to American buying. Incidentally, Americans are reported to have bought some Union Minière shares. In March the former company increased its capital by an issue of 2,000,000 shares, 1,500,000 of which were offered to old stockholders, at 22s. each. The money received was to be used in constructing the Benguella railroad and to take up its proportion of the new Union Minière shares issued at the same time. In July, for the first time, the ordinary shares received a dividend (1s. a share).

The Société Générale Métallurgique de Hoboken, which refines much of the metallic product of the Katanga, increased its capitalization from 28,000,000 to 40,000,000 francs in 1924, the Union Minière continuing its large interest therein. It has a cobalt and radium plant and a tin refinery. Construction of the electrolytic copper refinery at Oolen (initial capacity 32,000 tons yearly) is progressing normally.

As in previous years, three companies operated alluvial tin mines in the Katanga. The Geomines and the Union Minière each produced approximately 720 tons of high-grade cassiterite concentrates. The former company connected its mines at Manono with Mayumba, on the Congo River, by a narrow-gage railroad. This company is reported to have 25,000 tons of cassiterite in reserve. The Simkat company, operating in the same general region, had a small production, probably about 120 tons.

The four principal diamond-mining companies of the Belgian Congo, the mother company, Société Internationale Forestière et Minière du Congo (or Forminière), the Beceka, the Kasai, and the Luebo companies, together with Diamang, a sister company operating in the contiguous part of Angola, paid satisfactory dividends in 1925. In 1924 these companies produced 666,290 carats of diamonds, or about 17.2 per cent of the world's supply. In 1925 the production was considerably larger. The companies employ about 275 whites and 24,000 blacks. Their reserves, blocked out by detailed development, are very large. Though the business of these companies is to mine alluvial diamonds, local conditions force them to devote a large part of their efforts to railroad building, steamship operation, farming, and cattle raising. Forminière is issuing a topographic map of the colony.

The Forminière in 1925 is expected to produce about 236,000 carats; the Beceka will considerably exceed its 1924 production, which was 280,000 carats; the Kasai company will produce about 58,000 carats; the Luebo company will produce in the neighborhood of 23,000 carats, and the Diamang company approximately 125,000 carats.

During the year diamonds were found at a number of new localities in northeastern Belgian Congo and in Angola outside of the proven area, but none of these are as yet at least known to be of commercial value. Forminière in 1925 took up as mining claims 322 square miles covering the most promising part of the diamantiferous area in the northeast part of the colony. It is rumored that further development is to be carried on in the kimberlite pipes of the Kundelungu Plateau, several of which are owned by a subsidiary of Tanganyika Concessions, the Kundelungu Exploitation Co.

The gold placers now being worked are all situated in the northeast part of the colony. The principal producer is the Colonial "Regie," which operates the Kilo and Moto mines. It employs about 120 whites and over 14,200 blacks. The product of the mines is now sold to the National Bank of Belgium. In 1924, 3,605,904 kilos (115,940 oz.) of gold was produced, the greater part of which came from placers, although 250,876 kilos (8,067 oz.) came from crushing 32,029 tons of gold-bearing quartz. Chilean mills operated by electric power obtained from the hydro-electric power plant at Soleniama are used for reducing the ore.

The year 1925 was an unusually dry one in the Belgian Congo, and, in consequence, the production for the first nine months was about 2,544.865 kilos, and the production for the year was presumably about 3,400 kilos (109,320 oz.). Important new discoveries have been made in the gold region during 1925 by the Regie, and, in consequence, on Nov. 1, 1925, the reserves were reported to be 57,000 kilos (1,833,000 oz.)

The Kasai company, a subsidiary of Société Minière de l'Aruwimi-Ituri, the mines of which are operated by the Forminière company, presumably produced in the neighborhood of 100 kilos (3,210 oz.) of gold. The mining claims already accorded this company in the northeast part of the Belgian Congo have an area of 244 square miles. The Forminière, for its own account, produced some 50 kilos (1,605 oz.).

Compagnie Minière des Grands Lacs Africains, a subsidiary of the Upper Congo-Great Lakes Railway, is reported to have located west of Lake Edward five commercial gold placers. It also owns sapphire deposits in the drainages of the Ulindi and Elila rivers, in the same general region. Up to the end of 1924 about 3,000 kilos of gold

point of the Amur Railway, on the River Aldan.

Another company that has acquired a concession from the Soviet is the Ayan Corporation, Ltd., formed by the National Mining Corporation and the New Consolidated Goldfields, the property consisting of mining claims in the Okhotsk district of eastern Siberia. A completely equipped prospecting expedition arrived at the properties at the end of August, 1925, and is engaged in testing the ground by boring.

The French company Mines d'or du Katchkar has endeavored to regain possession of its properties in Russia. According to latest information the company's machinery has not be damaged, but requires overhauling. The Soviet is desirous of increasing the production of gold, which it finds as necessary as coal. The Spassky Copper Co. has increased its capital in order to repay advances and to undertake an examination of its concession in Russia.

Mines in the Far East

By W. A. Doman

THE Chosen Syndicate, operating in Korea, accomplished a fair amount of development work during 1925. In the early months discoveries in the Great Nurupi mine were exceptionally good, and at the end of January the positive ore reserves were 84,863 tons, valued at 11.3 dwt. per ton. Probable ore was estimated at 64,941 tons, with a value of 9.1 dwt. per ton, the total being 149,804 tons, with a gross value of 1,548,750 dwt. Later developments were not so good. At the end of September no important body of ore had been proved below No. 9 level, though it was expected to reach No. 11 level by the beginning of November. At the end of September the ore reserves had been increased to 198,000 tons assaying 8.96 dwt. per ton, of which there were blocked out 168,700 tons assaying 9 dwt. per ton. Experience in the mine is that a zone of low-grade ore is followed by one of higher grade, and this is now hoped for. Similar conditions have been encountered in upper levels.

Following the re-equipment of the Mawchi mine, in the South Shan States, and arrangements for ore transportation which had been in progress for several months, it was expected that the mine and mill would be ready to begin operations at the end of August. Owing, however, to prolonged and heavy rains, transport of machinery and the cutting of the necessary amount of timber required were delayed. Development, however, continued, and was reported to be uniformly satisfactory.

Malayan tin companies generally, made good progress in 1925. Many companies paid increased dividends owing to the higher price of tin and special mention is made of Malayan Tin Dredging, Southern Perak, Kamunting, and Tavoy. Two of the companies have obtained capital under the British government's Trade Facilities Act. Many small concerns largely directed from Cornwall have done remarkably well. Some companies have enlarged their capital, others have declared bonuses, and many new ones have been formed. Pahang Consolidated, which works tin lodes in the Federated Malay States, has not done so well. Deeper levels have not given good results and exploratory work is now being undertaken to find Willink's and Nicholson's oreshoots to the east of the main vertical fault.

Despite the greater output and the relatively low working costs, the price of tin has not declined. Funds have been readily forthcoming for this class of mining investment, estimates of profit being generally based on tin at £200 and upward, which allows good profits while the price of the metal is over £280 per ton.

The Southern Shan States Silver Lead Corporation, in which the Selukwe Gold Mining & Finance is interested, made fair progress during 1925, and some high-grade ore, 10 to 20 per cent lead, has been opened up. Production, however, is on only a small scale.

The Burma Corporation is not now feeling much of the effects of the fire in the mine. The Bawdwin, by the way, is the largest lead-silver-zinc mine of the British Empire. Hitherto the recovery of zinc has been low, but every effort is now being made to recover, in an experimental zinc flotation plant, as much of the metal as possible. Silver and lead recoveries are high, and now that the price of zinc warrants the treatment of deleaded tailings and other zinc products, the percentage of value recovered should be considerably increased. For the first three months of 1925, 68,200 tons of ore was milled, giving refinery products of 11,508 tons of lead and 1,183,622 oz. of silver. The refinery is capable of producing 5,000 tons of refined lead and 500,000 oz. of silver monthly, and it is gradually working up to this capacity.

Mines in India

By W. A. Doman

RELATIVELY little of interest took place in 1925 at gold mines in the Kolar district in India. Production was fairly regular, as may be seen from the fact that for the first eleven months of the year, the total tonnage crushed by the five companies—Mysore, Ooregum, Nundydroog, Champion Reef, and Balaghat—was 631,077 tons, yielding 358,484 oz. of gold, as compared with 685,309 tons and 392,889 oz. of gold for the whole of 1924. Occasionally rockbursts have occurred—there was one at the Ooregum in November — without however, affecting more than a temporary impression upon output. The usual alternating layers of good and poor ore was encountered, and, naturally, with increasing depth, strict supervision is necessary to operate the mines economically.

The Anantapur Co. ceased working its gold property at Anantapur in 1925 and is now opening up another property at Gooty, to the north. At present about 6,000 tons of ore averaging 10 dwt. per ton has been opened up, and a ten-stamp battery is to be taken from the old property and erected to mill the ore and provide funds for further development.

The Indian Copper Corporation made good progress in opening up ore reserves. At the beginning of 1925 the tonnage was 255,852 and at the end of October (the latest date) it had been increased to 416,963 tons.

The ore averages about 4 per cent copper, as against 3.13 per cent a year ago. Development work is being continued, and capital is provided as needed.

Japan and Manchuria

By H. Nishihara

Mining Geologist, Dairen, Manchuria

THE prevailing business depression of 1924 in Japan extended into 1925, and the record available to the end of the year shows only a little improvement as compared to that for 1924. The average monthly production of the Taio gold mine, in Kiushu, was 2,860 oz., and the property mentioned has its superior position over the Kushikino mine, the average monthly production of which was 2,600 oz. The Konomai gold mine, in Hokkaido, which had been idle for some time, resumed operation, beginning in January, and now occupies third place in production, with a monthly average of 1,100 oz. in gold. Two custom smelters, Hitachi and Saganiseki, both owned by the Kuhara Mining Co., have been regularly supplied with ores, principally from their own mines, the Takatama, Takeno, and Bajo, and their production amounts to nearly 50 per cent of the total gold output for the empire. Mineral production for Japan in 1925 from January to August inclusive is as follows:

Gold, oz.	186,369	Coal, tons	19,434,578
Silver, oz.	3,776,736	Oil, bbl.	1,106,267
Copper, lb.	38,746,607	Sulphur, tons	30,975
Iron, tons	40,676		

In Manchuria several notable changes have taken place at the Fushun coal mines and Anshan iron mines, both owned by the South Manchuria Railway Co. At Fushun the open-pit mining has lately been developed into prominence. The record for the past six years shows steady increase in the output and is as follows:

Year	Tons	Year	Tons
1920	3,129,835	1923	4,929,585
1921	2,727,700	1924	5,528,614
1922	3,858,629	1925 (est.)	5,800,000

Economic extraction of oil from the overlying oil shale which contains on an average 7 per cent of crude oil has been a problem for many years, and the latest news seems to indicate that the operating company has been successful in concluding negotiations with the Imperial Navy Department to supply its product at $20 per ton.

At the Anshan iron mines, where the greater part of the high-grade iron ore has been mined, the much-discussed question of treating the low-grade ores has been of late successfully solved by the company's engineers. The annual output of pig iron should be maintained at 100,000 long tons. The record of production for the last six years is as follows:

Year	Output, Tons	Year	Output, Tons
1920	75,474	1923	72,311
1921	57,183	1924	94,501
1922	66,544	1925 (estimated)	100,000

the Bischoff and Pioneer appear to be approaching the end. At the time of writing there is a prospect of a company being formed to work the Renison Bell tin lodes, on the west coast of Tasmania. Formerly these deposits were worked by small companies, but now that most of the oxidized ore has been taken out, a fairly large and well-equipped plant is necessary to treat the pyritic ore. Tin is produced in all the states except South Australia, either from alluvial or lode mines, but the greater part of the production comes from small operations. The product is sold to one or other of the buyers, who pass it on to the three commercial tin-smelting plants, the Sydney Smelting Co., the Mount Bischoff Co., and O. T. Lempriere & Co.

The closing of the Wallaroo & Moonta Mining & Smelting Co., followed by the closing of Mount Morgan, in the latter half of 1925, leaves Australia with only one consistent copper producer, the Mount Lyell Mining & Railway Co., and when one reads of the low costs of production in other parts of the world, the prospect of reviving copper mining in Australia is not particularly bright. Whether Australia will continue to produce sufficient copper to supply the Metal Manufactures, Ltd., at Port Kemble, which manufactures copper wires and cables, remains to be seen. It is almost certain that Mount Lyell will try to increase its output. There is talk of an attempt next year to reopen Mount Morgan by introducing open-cut mining and more economical smelting methods, but those in a position to judge are not hopeful that the shareholders will agree to put up the necessary money which will amount to a not inconsiderable sum.

Tasmania is the world's principal producer of osmiridium. Until recently the output came from "one-man" operations on the Savage River field, but a few months ago a rush began to a new field, known as the Adams River, in the southwest of that state. It is a wild and inaccessible region, and in September, 1925, it was reported that there were from 600 to 1,000 men there. For the three months ended Sept. 30, 1925, about 700 oz. was produced, realizing on the average £32 per oz. The large output resulted in temporary cessation of buying, so that the future is uncertain. Osmiridium is also found in the island of New Guinea, a territory controlled by the Commonwealth, but little information is available as to its production. An interesting venture is the formation of Caudrey's Osmiridium Co. in the Savage River field, to recover the metal from the ore. A mill is being erected and will soon be put in operation.

The only new development in respect to oil is the withdrawal by the Commonwealth government of the offer of a bonus of £50,000 for the discovery of oil in Australia. This money will be expended as grants to state governments or companies for boring and approved oil prospecting work. Dr. Arthur Wade, consulting oil geologist to the Commonwealth government, has approved of drilling of the Belford, Loder, and Sedgefield domes which are situated in the Singleton district of New South Wales.

Mining in Europe

By W. A. Doman

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LITTLE information is available concerning mining in Europe during 1925, as reports of developments are not published so frequently as is the case with companies managed in England. The Pena Copper Co. has written off two-thirds of its capital, because it was top-heavy and unwarranted, reducing the £1 shares to 6s. 8d.

In respect to the Libiola Copper Co., improvements effected in the electrical power installation during the last few years now give satisfactory results and enable increased production to be made with important economies. It is hoped to carry out exploration work more rapidly. Forward sales, both of pyrites and copper pyrites, have been good, and some rich copper ores have been sold in Italy. Reserves are equal to sales of nearly two years for copper ore, and three and a half years for pyrites.

Developments during the twelve months ended June 30, 1925, in the Huelva copper mine showed an increase in copper from 3.50 per cent in February to 5.80 per cent in March, 7.80 per cent in April, 12.80 per cent in May, and 10 per cent in June. Nothing special has been published concerning Rio Tinto.

Though the report of the Villemagne company is not yet available, good developments have taken place during the year, numerous beds of lead, zinc, and silver ore having been found. According to French reports, the mine promises to become one of the largest in the world. Before the Russo-Asiatic Consolidated took an interest in it—valued now at over £600,000 — the original owners had no suspicion of its worth.

The Mining & Industrial Co. of Plakalnitza has a capital of 5,000,000 francs, and operates copper and silver-lead properties in Bulgaria. A new plant is to be erected to treat the ore by the flotation process, and a contract has been made for the sale of the concentrates for a period of ten years to the Société Générale des Minerais.

Silesian zinc mines have operated under less favorable conditions, and many have had to reduce their output. The conditions have been largely due to a conflict with the German-Polish customs and the restricted demand from England.

In respect to the zinc deposits in Poland, negotiations between Giesche's successors in Berlin and the Harriman-Anaconda group, with the object of the latter acquiring important zinc mines in Upper Silesia, have been carried through to completion. The Harriman-Anaconda interests are owners of large zinc mines in Russia, and it is said are endeavoring to control the metal.

The tale of tin mining in Cornwall is one of progress. Sustained advance in the price of the metal has enabled not only financially shaky companies to enlarge operations by borrowing on favorable terms (including loans under the Trades Facilities Act), but has stimulated prospecting and the opening up of properties on which operations had been suspended.

Lead mining in Derbyshire has had a little fillip by the interest taken in the Mill Close by the Consolidated Goldfields of South Africa. The property, however, is only a small one. A move is being made to obtain capital to work an adjoining area asserted to contain a continuation of the Mill Close lodes.

Russia and Siberia

By W. A. Doman

ADMITTEDLY, Soviet Russia, including Siberia, contains an enormous metal wealth, both precious and base, but little production is recorded during 1925. The important work done by managements of Russian mining companies, particularly those registered outside of Russia, consisted of negotiations for the return of the properties which were nationalized some years ago. Some progress has been made in this direction, but whether it is altogether satisfactory is not clear, for the full terms of new concessions which have been granted or of old ones which have been returned have not been made public. The principal arrangement made during 1925 was that between the Lena Goldfields and the Soviet government. The properties have been handed back and stores valued at £1,000,000 have also been returned. But, under the plan agreed upon, the properties of the Lenskoie, Altai, and Sissert, together with other important areas transferred by the Soviet, are included. Shareholders in these companies are given the right to exchange to shares of Lena Goldfields, which will be capitalized at £4,191,744 and will mine gold, silver, copper, and other deposits. The production of gold at Lenskoie is at present at the rate of about £2,000 per day. A percentage of all minerals has to be handed over to the Soviet authorities, the property also reverting in from thirty to fifty years. During the first seven years the concessionaire has to pay 22,000,000 gold rubles. A gold concession in the province of Tomsk (Siberia) formerly granted to the Stolzenberg company and the family of N. Yakoblieff, a Russian, has been returned to the owners. This appears to be the first of the denationalizing.

The Russo-Asiatic Consolidated management has, like others, been in frequent communication with the Soviet over the return of the company's numerous and extensive precious-metal and base-metal properties, railway, and fleet, but has made little progress, and the value of over £50,000,000 placed upon the concessions by the directors remains unchanged.

One of the important features of the year was the discovery of the Aldan gold field, in Siberia. This is an alluvial field and was reported upon by the Soviet Commission of Investigation, which estimated that, within an area of 6,000 square miles, there are 4,000 tons of available gold. For such an estimate to be made, extensive prospecting must have been undertaken. The region is about 300 miles from Yakutsk, and 300 miles from the nearest

CURRENT PROBLEMS

Taxation Returns to Sounder Basis

Lower Federal Rates—State and Municipal Levies Improve

By Henry B. Fernald
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REAL PROGRESS has been made in 1925 toward the fairer consideration of tax questions and sounder bases of taxation. There has been a growing recognition that taxation is a financial problem that cannot be solved by political agitation.

The results of the 1924 elections had shown that the people were no longer carried away by ideas of punitive taxation against wealth, but that they wanted sound, economical government and business prosperity. The people were manifestly more interested in the reduction of taxes than in the expansion of the government's money-spending activities. With the country prosperous and the government economical, further federal tax reduction became a manifest possibility. With no attempt by the administration to force on Congress any particular program of tax reduction, either by calling a special session early in the year or by presenting its own revenue bill, Congress was in a mood to justify itself to the country by itself striving to draft and present a sound tax measure. This resulted in the almost unprecedented situation of a substantially non-partisan tax bill being presented to the House at the opening of its session and promptly passed by the House in a non-partisan spirit. The bill may be subject to some amendment in the Senate, but, with the general feeling that it is the best federal revenue legislation of recent years and that it has been drafted with an honest desire properly to meet the revenue demands of the government while dealing fairly with the taxpayers, there seems no reason to believe that the Senate will not in the same spirit enact it without essential change.

The Couzens committee has been continuing its investigations, but apparently in a less rancorous spirit. Its report has been for some time expected, but had not yet appeared at the time of this writing. Possibly it may lead to some modification of provisions in the pending bill, but it should hardly lead to any abandonment of the present attempt to enact a sound and equitable tax law.

Provision for creating a Joint Commission on Taxation, to consist of five Senators, five Representatives, and five of the general public, to investigate and report upon "the Federal system of income and other internal taxes" and any measures which might simplify or improve the operation or administration thereof, is included in the pending bill. If this commission is created and men of the expected ability are named as members, it should mean such progress in our tax system as no amount of political discussion could give. The Board of Tax Appeals, created by the Revenue Act of 1924, has fully justified its existence as a refuge from and rectifier of arbitrary or unwarranted action or decisions of the Revenue Bureau.

The Revenue Bureau itself is striving for a better, simpler, and more expeditious procedure in settling tax cases, and has adopted a general policy of decentralization, hoping that, so far as possible, all cases may be settled by the district examining offices. Some of this progress has been only possible because of the change in sentiment of the taxpayers. They have largely accepted the fact that revenue must be raised for the government and must be raised from those who have the ability to pay. With the reduction of tax rates, taxpayers have been more ready to give their own co-operation toward any fair and reasonable settlements of their cases, whereas when rates were as high as 60 or 80 per cent of income, they could not but press to the limit any contentions they might feel were justified.

The effective opposition by states and municipalities to the attempt, through constitutional amendment, to limit or abolish tax-exempt securities, made it inevitable that maximum tax rates must be kept within reasonable limits so as not to drive into the tax-exempt class those very incomes which the high surtax rates were intended to reach.

One doubtful experiment in the pending revenue bill is its attempt practically to force all states to levy inheritance taxes at rates of at least 80 per cent of those of the Federal tax. This it would do by allowing any state inheritance tax paid to be deducted from the payment to be made the Federal Government up to 80 per cent of the amount of the Federal tax. Therefore, any state which does not impose an inheritance tax or which imposes one at low rates will not thus relieve its citizens from any tax burden, but will in effect turn over to the Federal Government these moneys which the Federal Government virtually says it believes should go to the states. Under such conditions a state could hardly resist such legislation as would give the money to it. The wisdom and propriety of having the Federal Government dictate a tax policy for the states seems very doubtful. Possibly this experiment may be abandoned before the act is finally passed.

The situation as to general state and local taxation seems also to have improved. Demands for greater efficiency and economy in government have become such as to make a showing in this regard almost essential before there can be any tax increase. The people are feeling the effect of now having to pay for bond issues sometimes rather thoughtlessly made in the past and are not so enthusiastic about new issues.

All in all, the year under review has witnessed the return to sounder thought and action on taxation. Wars always bring out the power of governments to dominate every sphere of activity. There is a natural desire in a post-war period to have this power exercised to remedy all real or fancied wrongs. It takes some time

to come back to the realization that, after all, the government is merely an aggregate of individuals and is subject to the same financial laws as are the individuals. The moneys it spends must come from either the earnings or the capital of its people. Unless the government gets the worth of a dollar for each dollar it spends, it cannot justify its taking of the people's money. There has been during the past year a growing appreciation of this fact. It has bettered our existing tax situation and promises further improvement in the future.

Railroad Transportation

By F. R. Raiff

Vice-President American Smelting & Refining Co., New York

RECORD-BREAKING performances in traffic handled made 1925 a notable year in the railroad history of the United States. Up to Oct. 3 the railroads handled 42,293,060 carloads of revenue freight against the previous high record of 41,615,889 for the same period in 1923.

Freight has been moving freely, and with few delays, with the result that manufacturers, wholesalers, and jobbers are buying more closely and carrying less stock ahead for protection against transportation delays. The earnings of the railroads as a whole, for the first ten months of 1925, were on an annual basis of 5.56 per cent, based on the tentative valuation fixed by the Interstate Commerce Commission, as compared with 4.80 per cent for the corresponding ten months of 1924.

There were no unusual changes in the freight rate situation affecting the non-ferrous mines or metals in 1925, although efforts are being made by the railroads in Official Classification Territory—that is, east of the Mississippi River and north of the Ohio—to increase all rates on refined copper to a Sixth Class basis, the effect of which would be to increase the present rates in many instances by more than 50 per cent and an increase on a weighted average of around 40 per cent. This would mean an increased freight cost on copper of several hundred thousand dollars per annum; more than $100,000 in the case of one refinery alone. The railroads involved disclaim these efforts as a revenue measure, but insist that they are to remove discriminations and inequalities brought to their attention and to that of the commission by complaints of the scrap dealers and refiners of secondary metals. Tariffs carrying these advanced rates were published to be effective Aug. 17, 1925, but were suspended by the commission. Hearings were held in Washington in November, but decision is not expected until around Feb. 1, 1926.

Under the so-called Hoch-Smith resolution passed by the 68th Congress and approved on Jan. 30, 1925, the Interstate Commerce Commission is now conducting an investigation "to determine to what extent and in what manner existing rates and charges may be unjust, unreasonable, unjustly discriminatory, or unduly preferential . . . as between localities . . . classes of traffic, and the various classes and kinds of commodities." This is conceded to be for the benefit of the farmer, as the commission is directed to effect such lawful changes as may promote freedom of movement of the products of agriculture and of livestock at "the lowest possible lawful rates compatible with the maintaining of adequate transportation service." In conjunction with this investigation is also the one brought about by the request of the Western railroads for a general advance in rates such that their earnings may be brought up to the basis authorized by the transportation act of 1920. These investigations have resulted in uncertainty in practically all lines of industry as to what is in store for them in transportation costs following the decision of the commission in these cases, which will probably not be made and published for several months.

Ocean rates have been fairly well stabilized on a reasonable basis, and service is generally satisfactory. The intercoastal lines are maintaining a regular and dependable service and are handling a considerable tonnage of Western refinery and smelter products via the Canal.

Federal Mining Legislation

By Paul Wooton

Washington Correspondent, *Mining Journal-Press*

MINING LEGISLATION at the present session of Congress promises, as this is written, to be confined largely to coal, but whether or not any coal legislation will be enacted into law depends almost entirely on the extent to which the public is inconvenienced. If the latter part of the winter is severe, it probably will reveal that many householders went into the campaign against cold weather in a state of unpreparedness. This would result in a demand for legislation having for its objective the prevention of a recurrence of such a situation and would make certain an attempt to secure some form of coal legislation. If the latter half of the winter proves to be mild and no great amount of public inconvenience results from the strike, it is certain that other business will appeal more to Senators and Representatives.

At this time, however, the stage is being set for the active consideration of coal legislation. Proposals range from nationalization of mines to voluntary submission of basic facts. If a serious shortage in domestic fuel should develop, drastic legislation is entirely possible. Under such conditions Congress is not particularly conservative. The last fuel distribution act usurped no small amount of the authority reserved for the states and probably could not have withstood the first attack on its constitutionality. Under stress of popular clamor Congress might go to even greater lengths at this session.

Perhaps the best-known coal bill before Congress is that of Senator Oddie, chairman of the Committee on Mines and Mining. Though the Oddie bill provides for the compulsory return of basic data, it is regarded in Congress as a conservative measure. Since Senator Oddie simply compiled suggestions of others, he states that he has no pride of authorship and is willing to alter the bill to conform with the best advice that will be developed at the hearings.

It is apparent that a further effort will be made to persuade Congress to authorize reimbursement for losses suffered by producers of war minerals in connection with expenditures for purchasing or leasing properties and for interest paid on borrowed money.

Senator Pittman, of Nevada, whose bill authorizing the purchase of 14,589,730.13 oz. of silver at $1 an ounce all but became a law at the last Congress, feels confident that the measure can be put through at this session. The Senator contends that this constituted a

violation of the letter of the act, but rather than endure the delays incident to an interpretation of the law by the courts, he seeks a simple mandate of Congress for the purchase of an equivalent amount of silver.

The success, at the last session, in getting a bill through the Senate providing for $500,000 with which to prospect for potash has resulted this year in the reintroduction of the bill, but with the proposed appropriation increased to $1,000,000. Under the terms of the bill that amount would be turned over to the U. S. Geological Survey "for the purpose of determining the location and extent of potash deposits in the United States."

Labor Conditions at the Mines

By Albert H. Fay
Assistant Editor, *Mining Journal-Press*

BUSINESS activity and high metal prices both favorably affected the mining industry in 1925. Good markets resulted in full-time operation in most cases, with resulting benefit to labor. An outstanding and gratifying feature of the year was the absence of strikes or lockouts; nor does there seem to be any prospect of trouble in industrial relations.

Labor conditions improved throughout the metal-mining districts in 1925, and the situation in this respect is better than at any time since the war. No tendency toward a material change in the wage scale is apparent. Changes such as have taken place during the last six or eight months have been downward and affect only the less skilled labor.

There is an oversupply of unskilled labor in practically all Western districts, yet a good all-around miner can find employment in almost any camp in the West. Labor conditions in the Coeur d'Alene, Idaho, could hardly be better. The mines are operated on the open-shop plan, which was adopted several years ago. In the Michigan copper mines there was a slight shortage of labor throughout 1925, as many miners left the district three or four years ago and secured employment in industrial centers. These men are now returning, and the outlook indicates ample labor in 1926. The miners' basic wage is $4.25 per day, but the wages paid are higher as a result of much contract work. In Minnesota, iron mining has resolved itself into a more or less seasonal occupation by reason of the open-pit operations, which cannot be conducted so successfully during the winter.

An increased demand for both miners and other labor prevailed in Montana in the year under review, but the supply has been adequate. In Butte the contract system results in remuneration substantially larger than the posted wage scale. Apparently Colorado, Arizona, and Oregon are the only states where an actual shortage of skilled miners developed. The mining industry in Colorado and Oregon has been slack for several years, and many miners have left these states for other occupations. They are returning gradually, but there are still insufficient miners for the work now in progress.

The lead and zinc mines of Missouri had an exceptional year in both metal prices and contented labor. In Southwest Missouri and Oklahoma the wage scale is based on the price of ore, and in Southeast Missouri the basic underground wage is $5.05 per day, but contract miners earn from $7 to $9 per day. The majority of the labor in this district is composed of English-speaking workers.

Metal Mining Wage Scale Western States, 1925

(Compiled by the Colorado Mining Association)

Camp	Date Effective	First Motion Engineer	Geared Hoist Engineer	Machinist	Blacksmith	Timberman	Machine Man	Mucker Trammer	Cage Tender	Topman Common Labor, White	Pumpman	Remarks
Arizona												
Standard	Nov. 1, 1923	$6.33	$5.78	$5.23	$5.23	$5.23	$4.95	$4.40	$5.23	$4.40	$5.23	Shortage skilled labor
California												
Standard	Jan. 1, 1924	.....	4.50–6.00	.....	.....	4.50–5.00	4.50–4.75	4.00–4.25	.....	3.50–4.00	.....	Labor supply ample
Colorado												
Boulder	1923	.....	4.50–5.00	4.50–5.00	4.50–5.00	4.50–5.00	5.00	4.50	.....	4.50	.....	Skilled miners wanted
Clear Creek	1923	.....	4.50	6.00	4.50–6.00	4.50–5.00	4.50–5.00	4.00–4.50	4.25	3.50–4.00	4.50–5.00	Skilled miners and mill men wanted
Eagle County	1923	.....	5.25	5.00	5.50	5.00	5.00	4.00	4.25	4.00	.....	Labor supply ample
Lake County	1923	5.00–5.25	4.75–5.00	4.75–5.00	5.00–5.25	4.50–4.75	4.50–4.75	4.00–4.25	4.50–4.75	4.00–4.25	4.75–5.00	Labor supply ample
Mineral	1923	.....	6.00	5.00	5.00	5.00	5.00	4.50	.....	4.00	.....	Shortage skilled labor
Ouray	1923	.....	4.50–5.00	6.00	6.00	4.50–5.00	4.50–5.00	4.00	.....	4.50	.....	Labor supply ample
Pitkin	1923	5.00	5.00	4.50	5.00	4.50	4.00	4.00	.....	4.00	4.50	Labor supply ample
San Juan	1923	.....	5.00	.....	5.50	4.75	4.75	4.25	4.50	.....	.....	Labor supply ample
San Miguel	1923	5.00–5.50	5.00–5.50	6.00	5.00–5.50	4.50	4.50–5.00	4.00	4.50–5.00	3.50	4.50	Labor supply ample
Summit	1923	.....	5.00	4.50	5.00–5.50	4.75	4.75	4.25	4.50	4.00	.....	Labor supply ample
Teller	1923	.....	5.25	4.25	4.25–4.75	4.25–4.50	4.25–4.75	3.75–4.25	4.75	3.75–4.00	4.50–5.00	Labor supply ample
Idaho												
Coeur d'Alene (*a*)	May 1, 1925	.....	5.75	6.25	6.25	6.00	5.50	5.00	5.75	4.75	5.75	Labor supply ample
Montana												
Butte District	Nov. 1, 1923	6.00	5.50	5.50	5.50	4.75	4.75	4.75	5.25	4.25	5.50	Labor supply satisfactory
Nevada	1924	.....	5.25–6.00	5.75–7.00	5.50–7.00	5.00–5.75	5.00–5.75	4.50–5.25	5.00–5.25	4.00–5.00	5.25–5.75	Small surplus common labor; skilled miners wanted
South Dakota	1921	5.25	5.25	5.25–5.50	5.25	4.50	4.50	4.00	4.00	.....	5.00	Labor supply ample
Utah												
Bingham	April 16, 1924	5.25–6.00	4.75–6.00	4.75–6.00	5.50	5.00	5.00	4.50	5.00–5.25	3.75–4.50	4.50–6.00	Labor supply ample
All other camps	March 16, 1923	5.50–6.25	5.00–6.25	5.00–6.25	5.75	5.25	5.25	4.75	5.25–5.50	4.00–4.75	4.75–6.25	Labor supply ample

(*a*) Increased 50c. per day Nov. 10, 1925, based on price of lead.

Foreign Trade in Metals and Minerals

By Arthur B. Parsons
Assistant Editor, *Mining Journal-Press*

INCREASED EXPORTS of copper, lead, and zinc, in spite of disappointing foreign markets, are indicated in the accompanying tables, taken from the Department of Commerce records for the first ten months of 1925 and 1924. Imports of copper and lead declined, which, in conjunction with the large domestic consumption, reflects high production rates from the mines of the United States. The most striking figures, perhaps, are those of zinc export, both concentrate and slab zinc. The former is the consequence of large buying in Joplin and the Rocky Mountain districts to supply smelters in Continental Europe. Again, high rates of mine production in the United States are reflected. The reversal of the flow of gold out of, instead of into, the United States is notable.

Increases in the imports of tin, antimony, tungsten, platinum, cobalt, asbestos, and bauxite range from 10 to 60 per cent; the increase in tungsten being exceptional because of the meager imports of the preceding year. On the other hand, some decrease is to be noted in the importation of lime and limestone, corundum, emery, mica, salt, and other non-metallic products. Of most of these, however, production in the United States has been expanded to meet industrial requirements.

United States Commerce in Ores and Metals

Ten-month periods ending with October. Figures in pounds, unless otherwise stated.

I—Copper

	1924	1925
Imports		
Ore, concentrates, matte	117,679,556	139,285,439
Unrefined, black, blister	380,128,303	317,943,875
Refined	120,308,538	72,501,594
Old	2,404,114	8,942,599
Total	620,520,511	538,673,507
Exports		
Refined	822,598,064	845,085,164
Rods	52,091,166	47,890,359
Wire	8,638,659	10,261,002
Cable	13,399,875	12,851,617
Total	896,727,764	916,088,142
Manufactures	4,410,988	3,084,064

II—Lead

Imports		
In ore and matte	82,368,444	74,476,381
In bullion	131,734,223	107,587,528
In pigs, bars and other forms	23,578,261	12,391,179
Total	237,680,928	194,455,088
Manufactures (except type metal)	368,041	350,446
Type metal (lead content)	1,289,139	1,024,044
Exports		
In pigs and bars—		
From domestic ore	9,331,286	5,883,697
From foreign ore	113,454,842	175,297,149
Total	122,786,128	181,130,846
Manufactures	12,958,870	11,144,996

III—Zinc

Imports		
Ore	7,441,072	23,200,590
Blocks and pigs	39,449	41,720
Total	7,470,521	23,242,210
Zinc dust and manufactures	116,082	281,679
Exports		
Ore concentrates and dross	17,153,920	124,108,951
Slabs, blocks and pigs	96,177,028	140,543,165
Sheets, strips and other forms	6,110,554	7,048,598
Total	119,441,502	271,700,714
Zinc dust	3,887,583	3,680,275
Other zinc manufactures	760,109	1,190,658

IV—Gold and Silver

Imports	1924	1925
Gold, value	$289,584,485	$110,601,053
Silver, value	61,599,594	54,799,427
Exports		
Gold, value	15,284,478	232,311,992
Silver, value	89,209,997	83,420,022

V—Exports of Minor Metals and Minerals

Aluminum: Ingots, scrap	3,013,764	8,055,640
Manufactures	8,217,215	9,143,975
Quicksilver	12,399	12,515
Nickel, metal and manufactures	1,779,104	2,591,043
Platinum, oz	4,742	15,735
Tin bars	805,167	598,517
Tin manufactures	5,876,814	3,840,003
Asphalt and bitumen, tons	40,532	22,650
Manufactures of, lb	62,567,335	78,128,997
Sand and gravel, tons	237,162	331,526
Cement, bbl	783,202	817,449
Fireclay, tons	33,008	32,285
Other clays	23,185	30,507
Asbestos, tons	932	736
Gypsum	18,448,349	27,194,596
Mica and manufactures	1,281,293	2,124,965
Sulphur, tons	412,749	534,322
Salt	242,453,183	248,813,243
Graphite: Unmanufactured	1,774,884	1,630,816
Manufactured, except crucibles	1,201,023	1,987,005
Phosphate, tons: High grade hard rock	128,860	137,714
Land pebble	549,204	578,561
Other phosphate rock	10,487	11,051
Borax	28,232,881	27,914,138
Ocher, umber, sienna, whiting, etc	23,631,506	25,979,340

VI—Imports of Minor Metals and Ores

Aluminum	24,869,715	26,511,208
Antimony in ore	1,428,932	1,482,495
Metal	12,644,389	16,638,605
Cobalt	125,549	185,896
Platinum, oz	781,385	87,005
Iridium, oz	1,218	1,926
Osmium and osmiridium, oz	1,182	3,477
Palladium, oz	8,714	6,141
Rhodium and ruthenium, oz	1,338	3,421
Nickel: Ore and matte	8,524,717	7,508,770
In pigs, ingots, other forms	17,680,489	23,495,550
Manganese ore, tons	199,323	208,771
Chrome ore, tons	100,436	123,992
Tin, bars, blocks, pigs	124,607,893	144,756,668
Tungsten	78,981	2,246,634
Ferrochromium, chromium metal and chromium vanadium	787,547	1,144,765

VII—Imports of Non-metallic Minerals

Bauxite, tons	183,302	302,287
Marble, cu.ft	573,092	527,644
Sand and gravel, tons	500,960	409,288
Lime and limestone	38,963,707	27,461,699
Kaolin, china and paper clay, tons	265,457	277,469
Other clays, n. e. s.	66,420	45,463
Corundum, tons	2,794	1,290
Emery, tons	5,795	3,956
Flint, tons	14,380	13,069
Asbestos, unmanufactured, tons	132,510	169,096
Asbestos, manufactured, lb	18,893,794	26,304,002
Cryolite, tons	4,140	7,625
Chalk, crude, tons	84,941	81,999
Fluorspar, tons	36,878	38,864
Gypsum, crude, tons	394,668	433,678
Mica, crude	538,009	523,738
Mica, cut, split	4,681,739	3,885,013
Monazite, tons	144	.....
Diamonds, rough, carats	170,799	135,447
Cut, unset, carats	427,989	430,149
Pyrites, tons	207,284	521,067
Talcum, steatite, French chalk	30,323,462	34,614,821
Magnesite	136,494,303	132,157,896
Salt	180,201,043	143,240,723
Graphite	28,421,458	26,256,153
Mineral wax	2,510,879	4,439,246
Iodine, crude	.....	153,375
Nitrates, crude, tons	587	7,869
Ochers and sienna	16,496,733	17,162,307
Other pigments	61,444,705	69,749,674
Potash, tons: Crude chloride	99,340	133,868
Crude sulphate	50,153	54,499
Kainite	119,372	156,438

VIII—Iron Ore and Pig Iron

Exports		
Iron ore, tons	577,043	587,366
Pig iron, tons	37,456	25,771
Imports		
Iron ore, tons	1,641,801	1,704,245
Pig iron, tons	171,086	353,380

Equipment Lines Widened and Improved

Marked Progress Made in Design of Thickeners

By A. H. Hubbell
Managing Editor, *Mining Journal-Press*

PROGRESS in the development of new machinery for mines and metallurgical plants was more marked in some cases than in others in 1925. Practically all manufacturers of the major lines of equipment used in the industry introduced something new or rounded out the range of sizes and models carried, the better to serve their clientele and at the same time to meet the keen competition to be faced. Some new equipment of considerable interest was produced. In the following a condensed summary of the advance reported in each line is given:

Drills—Two new lines of rock drills were introduced by a new entrant in the manufacturing field. One of these comprised six machines of the hand-held hammer type for service ranging from drilling plug holes to heavy sinking; the other included ten mounted hammer drills intended for all work that light and heavy drifters are called upon to do under the varied conditions of breaking rock. Another prominent maker brought out a one-man drifting drill; also a heavy hammer-type machine of simple design and with easily replaceable parts. Another machine introduced was a light rotating water stoper of the valve type. Refinements and minor improvements in existing lines were numerous. The effort to reduce the weight of drills for given performance continued. A new machine for heat-treating rock-drill bits automatically was announced.

Compressors—Several interesting models in portable compressors made their appearance. One of these was an electrically driven machine having two single-acting vertical cylinders carried directly over one of the truck axles, this reducing vibration so as to permit high-speed operation, the whole unit being mounted on a cast-steel truck with flanged wheels for mine use. In another model, reduction in vibration was secured by counterbalancing four cylinders, in two pairs, on a single crankshaft, the pairs being set at 45 deg. to the vertical and 90 deg. apart. One maker claimed to have increased the compressor efficiency of his 100 ft. gas-engine-driven machine 12 to 15 per cent by use of a patented supercharger. Improvements in compressor drive were also effected. The use of the direct-connected synchronous motor, hitherto successful with larger machines, was extended to the operation of compressors of 1,000 cu.ft. capacity and less, a so-called "flywheel-type" motor of special design being developed for this purpose. A new type of synchronous motor was also developed for direct drive of slow-speed compressors. Abroad, a rotary compressor was developed embodying the main structural feature of the Hele-Shaw rotary oil pump, and steps were taken to manufacture gas-engine-driven portable sets to run at 1,000 r.p.m. with capacities of 70, 120, and 240 cu.ft., working at 80 to 100 lb. pressure and requiring 18, 30, and 60 hp. respectively. An inventor in the United States produced, in model form, a valveless rotary compressor of curious design.

Fans and Blowers—A 30 by 10-ft. fan, with a capacity of 900,000 cu.ft. of air per minute on 7-in. water gage at 125 r.p.m., said to be the world's largest fan, was built for a South African mine by an English firm. For secondary mine ventilation a domestic manufacturer produced a new compressed-air-driven high-pressure centrifugal blower for delivering air through small ventilating pipes of great length. Refinements in the design of centrifugal blowers and compressors leading to higher efficiencies and improved operating characteristics were made. One maker furnished two two-stage blowers for the New Cornelia flotation plant, each to deliver 20,000 cu.ft. of air per minute against 5-lb. pressure at 3,600 r.p.m. and driven by a synchronous motor; and three two-stage compressors each to deliver 20,000 cu.ft. of air at 4¾ lb. at 3,600 r.p.m. driven by an a.c. motor at 750 r.p.m. with a double helical speed-increasing gear. For metallurgical work turbo and rotary types of blowers continued to hold their own, each with respect to the other. Super-synchronous motors were applied for the first time to mine-fan drive, decreasing the maintenance and power cost.

Haulage—Electrification of a mining company's railroad in Chihuahua involved the first application ever made of regenerative braking to a 600-volt railroad. Into this service were placed in 1925 five 25-ton units equipped for such braking (the first industrial units so equipped) and arranged for tandem operation. Another important development was that of a 60-ton oil-electric locomotive, built jointly by three companies, and given trial on various roads in the East. It consisted of a 300-hp. engine direct-connected to a d.c. generator supplying power to four geared generators. As to smaller haulage units, greater popularity of gasoline locomotives for pit, quarry, and plant use was indicated by the introduction by several makers of new models ranging in size from 4 to 20 tons.

Pumps—Multi-stage centrifugal and multi-plunger vertical pumps, with their smaller space requirements, continued to gain in favor over units of the horizontal type for intermediate and deep-level pumping, with smaller centrifugal pumps most popular for shallow lifts. Wider application of deep-well pumps to mine work for lifts not over 400 ft. was reported by one important manufacturer. Increased use of automatic control of pumping called for new automatic installations, and the introduction in coal mining of an automatic multi-sump valve for gathering with one pump from several sumps was a development of general interest. Improvements of varying degree in pump design were numerous. A new multi-stage station pump was introduced, having a double volute passage surrounding each impeller, eliminating the use of diffusion vanes, this giving a simpler and more efficient pump. Adoption of speeds of 3,500 r.p.m. in the smaller sizes of centrifugal pumps made it possible to develop the necessary heads with still smaller and more efficient impellers. Other changes in centrifugal pumps included the development of a means of neutralizing end-thrust. A centrifugal boiler-feed pump to work under 1,300 lb. was introduced, its maker also succeeding in turning out a simple, accurate hot-water meter for boilers up to 300 hp.

Equipment

Hoists—Increased use of electric slusher hoists and the introduction of new models marked scraping practice. This was a manifestation of the general trend toward electrification. For ore and man hoists a new size liquid type control for 75 to 150-hp. motors was completed, the success of this control on larger engines causing it to be extended to those of moderate size. Several new models of cranes of locomotive, truck and tractor type were introduced. A new wire rope with wires and strands "preformed" to the exact shape they must have to fit in the completed product appeared.

Shovels—Two companies developed shovels of intermediate capacity to fill the gap between the large 8-cu.yd. machine and the small revolving group. These were, respectively, a 3-cu.yd. and a 4-cu.yd. full revolving shovel, both mounted on crawler trucks and built for either steam or electric power. Electric shovels driven by three shunt motors with Ward Leonard control were introduced, the application of this combination to the thrust being considered entirely new. Use of crawler trucks increased. Caterpillar mounting was applied to an 8-cu.yd. 400-ton dragline. Construction of a dipper dredge, the largest yet built and Diesel-driven, was undertaken. Many improvements were made in details of shovel construction. A new dipper front of more rugged construction and of manganese steel was developed.

Makers of underground loading machines made various improvements in construction details. Some new models of existing types were introduced, one being only 39 in. high above the rail and able to work in 42 in. headroom. An auxiliary turnable conveyor, swinging 360 deg. and adjustable in all directions, for use back of loaders of this type, was developed for delivering material to the side.

Crushing and Grinding—Details of design of crushing machinery found successful on certain sizes of machines were adapted to other sizes. One manufacturer adopted the gunlock type of mantle on all his crushers, having found it better than hold-down bolts previously used. Construction of several 60-in. gyratory crushers much heavier and more rugged than previously built was begun, each weighing close to a million pounds and built almost entirely of steel castings and forgings. The same maker added an 18-in. machine to a well-known line of "fine-reduction" gyratories hitherto consisting only of a 6-in. and 10-in. size. Another firm built some ball mills 9 ft. in diameter and 7 ft. long, the largest of their type. These mills will be directly connected to synchronous motors with only a single gear reduction. Two ball mills with interesting modifications in design were announced: one a mill divided into two or three grinding compartments and ranging in size from 6x20 ft. to 8x30 ft.; the other a single-compartment ball mill with wedge-shaped end liners through which the discharge takes place and which, it is claimed, serve to intensify and accelerate the grinding action by producing a ball movement lengthwise of the mill. A new pulverizer using nine grinding elements of the roll-tire type on a rotating horizontal table which is surmounted by an adjustable air-separation chamber was introduced for pulverizing coal and other materials. A steel-frame single-roll crusher of sturdy construction for coal preparation was also developed. Some 6½x12-ft. rod mills using 5½-in. rods were built, as well as some 6x12-ft. mills of the same type, with special features, for dry grinding.

Screens—The assortment of wire cloths available to users was greatly increased during the year, this resulting from the large number of uses that have developed for screening material.

Classifiers—A development of note was the increasing use of the bowl classifier for a variety of purposes. Two new rotary air classifiers for use in dry grinding in connection with conical ball mills were introduced. A six-compartment hydraulic classifier of so-called "constant-density" type, developed some time ago, has been widely adopted in the Cœur d'Alene region.

Thickeners—The outstanding feature of the year was the announcement of the development of three new thickeners. The first of these was the so-called "super-thickener" and clarifier developed at the Golden Cycle mill, in Colorado Springs. This is so designed as to increase the settling rate of solids and to secure the delivery of thick underflows. The thickening tank is provided with a bottom porous only to the liquid in which the solids are suspended and with mechanical means for cleaning the surface of porous bottom so as to maintain a permeable filter medium. The filtrate is drawn through the bed continuously. The Genter thickener, developed some years ago and adapted to metallurgical purposes recently at Trail, was the second. In this a framework of perforated tubes covered with canvas "socks" is submerged in the pulp, and by connecting the inside of the tubes and frame to an automatic valve, the cycle of filtration is governed under vacuum and liquid countercurrent for removing the cake. The third was the so-called "traction" thickener which underwent development during the year so that it can now be provided in sizes from 20 ft. diameter up. Its mechanism is equipped with peripheral drive.

Filters—A new continuous centrifugal filter was announced. Use of continuous filters of the multiple disk type for certain specialized classes of work greatly increased. Numerous improvements and modifications in filter construction were made.

Concentration—New types of tables and new sizes of roughing and slime tables were introduced. The running-in-oil mechanism used by one maker was greatly improved. A new worm-drive for tables operated by individual motors was developed; also the use of rubber riffles. Two new flotation machines were announced, one of the pneumatic type and the other of the mechanically agitated type using a novel method of insuring aëration. Various improvements were made in magnetic concentration equipment. The use of the magnetic pulley for removing tramp iron was extended to pan conveyors.

Power—Progress was made in Diesel construction, three units of 3,750 hp. each being built for the Panama Canal, these exceeding in horsepower those made by the same manufacturer for the Phelps Dodge Corporation, hitherto the largest in the United States. The same maker rounded out his line of medium-sized units by the addition of a 3-, 4-, 5- or 6-cylinder engine rated at 150 hp. per cylinder at 225 r.p.m. The two-cycle double-acting Diesel experimented with in 1924 was followed by the construction of two four-cylinder 3,000-hp. engines. A decided trend toward electrification of plants was evident in many instances. Several types of speed reducers and flexible couplings appeared. A short-center flexible drive consisting of two grooved sheaves and several specially constructed endless "V" belts, eliminating slip, back lash, and lost motion, was introduced. It was intended for drives of from ½ to 250 hp. Many power plant accessories appeared.

MARKETING AND STATISTICS

Copper Demand Reaches High Point

Low Level of Metal Stocks in Producers' Hands

By Joseph Clendenin
Manager, Sales Department, Guggenheim Brothers, New York

IN REVIEWING the copper position, the most significant and perhaps the most important feature has been the large demand for the metal and the relatively low price obtained for it throughout the year, as follows:

Deliveries	Total (Tons)	Stock at End	Reduction in Stock	*Mining Journal-Press* Quotations, Cents per Pound High	Low
First quarter	341,808	122,348	14,086	14.875	13.20
Second quarter	368,324	91,326	31,022	13.55	13.00
Third quarter	354,956	69,007	22,319	14.75	13.50
Fourth quarter	350,636	73,019	4,012 (*a*)	14.625	13.75
	1,415,724		63,415		

(*a*) Increase

The entire production of marketable copper during the year has been delivered for consumption and 63,415 tons additional, yet the price obtained, as reflected by *Mining Journal-Press*, has ranged from a high of 14.875c. in January to a low of 13c. in April, with the quotation at its lowest and deliveries at their highest during the second quarter.

Takings for 1925 exceeded those for 1924—which was a record for all peace times—in the aggregate by 7.27 per cent; the domestic takings increasing by 10.33 per cent and the export takings by 3.21 per cent.

In all probability there will never be such an opportunity as was afforded in 1925 of adjusting the price to supply and demand, in that the stock has been cut in half and been brought down to a two weeks' supply. It might be said that this is a case of hindsight, but those closely associated with the selling department of the business have known of this picture at all times through the year. In effect, the price receded from 15c. at beginning to 14c. at the end of the year.

Production throughout 1925 held fairly steady at the rate of 108,000 tons per month, with practically no change from month to month over last year's average, the aggregate increase being 4 per cent over last year; but for this small increase the stock would have been brought down to 21,042 tons—equal to five days' supply.

Practically this same condition of supply and demand, with continuous decrease in stock and variation in price, has existed over the preceding three years:

	Average Monthly Deliveries Total, Tons	Stock at End	Reduction in Stock	*Mining Journal-Press* Monthly Average, Cents per Pound High	Low
1922	75,617	149,393	118,575	14.074	12.567
1923	96,449	155,885	6,492 (*a*)	16.832	12.574
1924	109,982	136,434	19,451	14.260	12.327
1925	117,977	73,019	63,415	14.353	13.866

(*a*) Increase

Stocks decreased in these four year 194,949 tons.

A better-balanced, more consistent selling policy for the coming year ought to be productive of better results to the mining companies, as well as to the consumers, who recognize that copper is selling too cheaply and who would welcome a greater degree of stability as helpful in their own business. This same relation of price to supply and demand has maintained during the past five years.

Stocks, Refinery Production and Shipments, in Tons, and Price of Copper, 1921-1925

At End of	Stocks of Marketable Copper	Refinery Production North and South America	Domestic Shipments	Export Shipments	Total	Price Average for Year F. o. B. Refinery, Cents
1921	268,000	537,200	307,300	282,700	590,000	12.502
1922	149,400	788,800	549,800	357,600	907,400	13.382
1923	155,900	1,163,800	735,500	421,900	1,157,400	14.421
1924	136,434	1,300,332	753,389	566,395	1,319,784	13.024
1925	73,019	1,352,309	831,171	584,553	1,415,724	14.042

Distribution of Refinery Shipments for Years 1924 and 1925

(In short tons)

Shipments to	1924 Tons	1924 Per Cent	1925 Tons	1925 Per Cent	Tons Increase
United States	753,389	57.09	831,171	58.70	77,782
Belgium	39,937	3.03	45,419	3.21	5,482
Canada	6,370	.48	12,281	.87	5,911
England	114,114	8.65	113,505	8.02	(*a*) 609
Far East	38,833	2.94	13,217	.93	(*a*) 25,616
France	119,050	9.02	96,547	6.82	(*a*) 22,503
Germany	125,036	9.47	151,043	10.67	26,007
Holland	31,249	2.37	49,269	3.48	18,020
Italy	69,721	5.28	80,093	5.66	10,372
Norway and Sweden	14,931	1.13	14,093	1.00	(*a*) 838
Others	7,154	.54	9,086	.64	1,932
Totals	1,319,784	100.00	1,415,724	100.00	95,940

(*a*) Decrease

The stock of marketable copper Jan. 1, 1925, was 136,434 tons and on Jan. 1, 1926, 73,019 tons, showing a reduction in the twelve months' period of 46.5 per cent.

Copper is in a sound, strong statistical position, with stocks brought down to a little more than a fortnight's supply, located at eleven refineries in this country and South America; with the Japanese stock cut in half during the year and with consumers here and abroad buying only as they sell, carrying no surplus stocks.

The following table shows how all non-ferrous metals have advanced since 1913, except copper, which has declined:

	Cents 1913	Cents Present Time
Copper	15.269	13.75
Lead	4.37	9.25
Zinc	5.50	7.725
Tin	44.25	63.50

America is taking 56 per cent and Europe 44 per cent of the current American refinery production, which compares with 41 per cent for America and 59 per cent for Europe in 1913.

A summary of the year's business shows:

1. A fairly well-balanced production.

2. Much the largest home consumption in the history of the business, the takings being more than double those for 1913 (being approximately 110 per cent in excess of 1913).

3. The foreign consumption steadily growing, being approximately 25 per cent in excess of 1913.

4. Stock held by producers equal to two weeks' supply for this country, Europe, and Asia.

5. Stock held by consumers: in this country normal; in foreign countries nil.

6. Price below its proper value based on supply and demand and comparison with other metals in the same class.

7. A large vacuum in the world's requirements yet to be filled, especially in Europe.

All the copper and brass mills in this country were well supplied with orders at the close of 1925, and the outlook for business in 1926 is distinctly good. The foreign demand continued at a record rate through the first half of the year, but fell off in the second half about 20 per cent. The copper industry is greatly interested in the progress of Europe toward normal conditions.

At the closing price for 1925 of 14c., copper is relatively much cheaper than most others of the non-ferrous metals, nine of which are now selling at higher prices than a year ago, the only exceptions being copper and lead.

The Copper and Brass Research Association has been largely instrumental in extending the use of copper and brass in this country. A somewhat similar association is in contemplation by the European distributors of these metals.

The Bureau of Metal Statistics initiated a new policy of publicity during 1925, changing from quarterly to monthly reports and placing the fullest obtainable information as to production, deliveries, and stocks at the disposal of the public in the early days of each month.

Lead Continues to Break Records

Consumption Close on Heels of Production

By F. F. Colcord
Vice-President, U. S. S. Lead Refinery, Inc., New York

LARGEST PRODUCTION of lead the world has ever known marked the year 1925 and also the highest average yearly price. Production exceeded that of 1924, which was of record-breaking proportions, and the lead industry seems to have come back to a normal condition after the slump following the end of the war. Figures of consumption are not readily available, but the fact that the average yearly price has increased each year since 1921 would indicate that consumption is right on the heels of production. The average yearly prices of lead in New York as reported by the *Mining Journal-Press* for the years 1921 to 1924, inclusive, and estimated for 1925, are, respectively, 4.545c., 5.734c., 7.267c., 8.097c., and 9.020c. per pound.

Features of the year's market were the culmination in January of the rising market, which had advanced uninterruptedly since May, 1924; a decline from January to the end of April, although even then the lowest price was 1c. above the lowest price of 1924; a temporary rally during May and June, with a slight setback in July; and then a steadily rising market until December, when the market weakened slightly, but showed considerable strength toward the end of the year.

The highest price, 10.575c., New York, was realized on Jan. 15, 1925. This was the turning point, and a decline in the London market took place between Jan. 12 and 21, the price dropping about £3 15s., due to heavy German speculative selling. In spite of scanty stocks and a very high rate of consumption, both here and abroad, the New York market broke sharply following the reaction in London. A steady decline in the American market from this time on was noteworthy in that consumption continued unabated and stocks were small. Practically the same situation prevailed abroad, but the London market led the way downward. New York's lowest price on this movement was 7.7c., on April 21. The market, however, was in a sensitive condition, and only a slight change of feeling was needed to arrest the decline and start prices upward. Such a change took place in late April, when the demand became good, with some eager buying. There were all the possibilities of a runaway market, which the large American producers evidently tried to prevent by continually selling below the market to their regular customers and refusing to sell to speculators; and, if that was their objective, it was successful, as large quantities of lead were sold without a material increase in price. When the consumers realized that there was enough lead to go around, the eager demand slackened and the price declined moderately. Prices in London fluctuated in the same manner, except that the price rise was less than the decline, and the next movement into higher ground started in London. High and low prices on this minor movement were 8 45c. on June 1 and 8.0c. during the first half of July.

The second half of the year was marked by a fairly stabilized market. Quotations rose gradually during July and August, until 9.5c., New York, was reached. Demand was good, and with the producers evidently trying to prevent inflation and the consumers realizing there was enough lead for their needs, the price remained at 9.5c. during September and October. In November there was an advance to 9.75c., but in December a decline to 9.25c. took place, with indications at the close of the year that an advance was likely to occur.

Lead produced in the United States, Canada, and Mexico in 1925 passed freely and uninterruptedly from the producers to the consumers, but in other parts of the world there were serious interruptions. In February, fires in the Burma mines curtailed production, and the output of the Rhodesian Broken Hill mine was interrupted through failure of the underground pumping plant. These interruptions continued well into the year. A shipping strike in Australia during July retarded deliveries to England and the Continent.

Consumption of lead by cable and storage-battery manufacturers and corroders in the United States and England was of large proportions in 1925. In other countries the demand was correspondingly large for cable and storage batteries. Germany and Italy used larger quantities than previously.

The lead price movement in 1925 was similar to the movements of 1923 and 1924. The high point in these years was reached in the early part of the year and the low point in July, with a rising market for the

with the current demands of the domestic smelters and the occasional demand for export.

The price level for zinc is fairly high and, with domestic supply and demand fairly balanced, is likely to remain so. There are indications that we have seen the worst in Europe, and it would not be surprising were a fresh demand for export of zinc from this country to develop in the near future. Should such demand coincide with a rate of domestic consumption now current it will be found difficult to fulfill.

Zinc Statistics of the United States (*a*)

In Tons of 2,000 Pounds

	Stock at Beginning	Production	Total Supply	Exports	Stock at End	Deliveries for Domestic Consumption
1922	68,524	373,678	442,253	30,286	18,352	393,615
1923	18,352	531,202	549,572	49,202	37,220	463,150
1924	37,220	535,846	573,091	72,583	21,208	479,300
1925						
January	21,208	50,386	71,594	12,974	18,996	39,624
February	18,996	46,811	65,809	8,688	16,703	40,418
March	16,703	51,485	68,188	6,364	17,196	44,628
April	17,196	48,851	66,047	5,302	18,337	42,408
May	18,337	49,738	68,075	6,000	21,210	40,865
June	21,210	45,921	67,131	5,182	22,906	39,043
July	22,906	47,583	70,499	9,171	20,771	40,557
August	20,771	47,849	68,625	4,931	17,032	46,662
September	17,032	47,384	64,419	4,417	11,796	48,206
October	11,796	50,497	62,293	6,844	7,475	47,974
November	7,475	50,629	58,104	3,722	6,922	47,460
December	6,922	53,794	60,716	1,532	9,295	49,889
Totals	.....	590,928	.....	75,127	.....	527,554

(*a*) Compiled from statistics of the American Zinc Institute and the Bureau of Foreign and Domestic Commerce.

U. S. Zinc Smelter Production, 1920-1925 (*a*)

In Tons of 2,000 Pounds

	1920	1921	1922	1923	1924	1925
Arkansas	29,966	14,917	16,146	30,038	28,415	27,166
Illinois	109,483	52,183	77,929	81,484	96,062	115,000
Missouri-Kansas	25,131	31,784	23,966	46,603	32,927	25,608
Oklahoma	97,690	36,644	74,568	123,352	133,976	159,645
Electrolytic	57,441	11,553	55,349	71,073	77,498	79,010
East and others	160,061	68,533	125,720	178,652	166,968	184,499
Totals	479,772	215,614	373,678	531,202	535,846	590,928

(*a*) Figures through the courtesy of the American Zinc Institute.

Zinc Production of Important Countries (*a*)

In Tons of 2,000 Pounds

Country	1920	1921	1922	1923	1924	1925
United States	435,153	195,601	339,001	481,906	486,119	590,000
Canada	16,795	24,035	25,204	27,238	24,896	37,700
Belgium	84,260	66,150	112,290	147,040	162,990	189,000
Germany and Silesia	97,465	90,000	110,410	116,022	118,108	173,000
Great Britain	25,000	5,910	18,624	31,782	39,098	46,300
Australia	9,820	1,708	23,895	41,813	47,360	51,500

(*a*) Figures from American Bureau of Metal Statistics; 1925 production estimated from eleven months' output.

World Gold Production Shows Slight Gain

Canada and Russia Increase Output—United States Diminishes

By H. N. Lawrie
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WORLD GOLD PRODUCTION in 1925 is estimated at $389,500,000, an increase of $300,000 over the revised estimate of 1924. The productions of two consecutive years have never been so closely alike, and even with the precaution of obtaining cabled estimates from a larger number of producers than usual, the final estimate for 1925 may indicate a decline.

The gold production of Canada in 1925, $35,700,000, indicates an increase of $4,200,000; of Russia, $15,200,000, an increase of $3,400,000; and in the Transvaal, a record production of $198,200,000, an increase of $270,000. Western Canadian output was about the same as last year, so that the increase has come largely from Ontario, where additional milling facilities were put into operation. Still further expansion in the installation of milling equipment is anticipated in 1926, so that the production in Canada will probably be greater next year. The increase in Russia was due largely to the activities of small private producers, who contributed in the aggregate 23.5 per cent of the total production. The Soviet plans, through the continued improvement in both placer and deep-mine equipment, to increase the production for the government's fiscal year ending Sept. 30, 1926, to $20,000,000.

Production in Continental United States, $47,300,000, indicates a decline of $3,200,000; in Australia, $11,500,000, a decline of $2,300,000; in Rhodesia, $12,000,000, a decline of $1,000,000; in Mexico, $16,100,000, a decline of $400,000; and in British India, $8,100,000, a decline of $100,000. Still smaller changes are indicated in other countries. With the prospect of declines in the production of the United States, the Transvaal, Rhodesia, and Australia, to compensate for the increases which may occur in Canada and Russia, no marked change in the world's gold production in 1926 is anticipated.

Production of gold in the Transvaal in 1925 is estimated at 9,588,300 oz., a slight increase of 13,199 oz. over that in 1924. The highest price for gold quoted in London, during 1925, was 87s. 9d., on both Jan. 1 and 2, from which point, with minor fluctuations up and down, the price declined to 85s. 6d. on April 23. On May 17, South Africa returned to the gold standard, and with a view of saving commissions and transportation costs on the sale of gold, 1,674,735 oz., or 17.5 per cent of the current gold production, were minted by the government in 1925. The quotation on April 28, the day Great Britain announced her return to the gold standard, was 86s. flat, as compared with 84s. 11.45d., the mint par, declining abruptly on April 29 to 84s. 11d., slightly increasing to 84s. 11½d. on April 30, where the price remained, with slight fluctuations, no higher than the former and no lower than 84s. 10½d. for the remainder of the year.

Production of gold in the Transvaal for each of the first six months of 1925, with the exception of February, was greater than for the corresponding month of 1924. Beginning with July, on the seventh of which the lowest price of 84s. 10½d. was first quoted, the production of each successive month in 1925 was correspondingly lower than in 1924. Increased monthly production in the first half of 1925 may be attributed to the higher prevailing price and favorable labor conditions, while the decline in the last six months is due largely to the lower price and a shortage of native labor. Beginning in October, there was a progressive decline in output, which indicates that the Transvaal production will probably be less in 1926.

The Bureau of the Mint, in co-operation with the

remainder of the year. These three years have been prosperous ones in the United States, and the price movement is probably more cyclic than seasonal. When the price of a metal goes beyond its intrinsic worth the market becomes increasingly sensitive to outside influences, consumers become unsettled, demand is strangled, and buying is reluctant. Though in 1923-24-25 there were particular causes for the checks to the rising market, these causes would have had far less effect if the price had not been as high as it was.

If business conditions continue in 1926 to be as favorable as they were in 1925, it is probable that lead will command about the same price as for the last year. The high average price of 1925 undoubtedly stimulated production, as is indicated by the record production, and a continuation of these prices will be necessary in order that production may keep up with consumption. There is enough lead available in the near future to fill consumptive demand provided the price is at a level to make it profitable to produce the lead.

Zinc Situation Continues Encouraging

Domestic Consumption Offsets Falling Foreign Demand

By E. N. Hickman
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"ALL FACTORS governing the zinc industry point to a good market and possibly higher prices. This tendency can be jeopardized by temporary over-production, excessive future commitments by consumers, or a definite turn in world-wide industrial activities. At this writing there are no such signs, and the outlook is one to hearten those who have seen the zinc industry through a long dark lane and now foresee the turning."

In the limited space allotted here to those who review or would anticipate the market trend of non-ferrous metals, a quotation from an article in last year's Annual Review, as is the above, may seem out of place. It prefaces this year's article because it happens to be right in its conclusions, although only partially right in its premises. There are decided differences between the present outlook for zinc and that of last year, although the same encouraging view seems justified now as it was a year ago.

Until quite recently foreign demand for American zinc was an important market factor here. During 1924 our exports rose from 4,000 tons per month at the beginning of the year to 10,000 at its close; in 1925 they dwindled progressively from 8,000 tons per month to some 1,500 tons. Notwithstanding, the price of zinc —which declined in 1924 from a high of 7¾c. per pound East St. Louis to nearly a cent lower by mid-summer and which, closely following export demand, rose again toward the end of the year to 7¾c.—was maintained throughout most of 1925 well above 7c., and is at this writing over 8½c.

Before examining the situation here, which has enabled us to part company with the European market and, in the face of a falling market there, to register further advances here, it is proper to survey the European zinc situation. It is not unlikely that Europe will again become an influence in our market, even though at the moment we are about three quarters of a cent per pound apart. Contrary to the expectation of last year that Europe would need from this country about 10,000 tons of metal per month, the immediate outlook is that little, if any, except some high-grade will be needed. Production in Europe is now practically unchanged from what it was at the beginning of 1925, and stocks, though they have increased in recent months, are relatively light. However, England, the chief recipient of our metal, has of late found increasing supplies available from the Continent; there, due largely to political and financial unsettlements in France, and acute credit and money stringency in Germany, combined with tariff complications with Poland, consumption has deteriorated, and a general bearish sentiment has been increasingly prevalent. It is a tenable view that the current troubles of the Continent are a necessary, albeit unpleasant, development in a process of improvement, and that the future is likely to see a healthful growth of industrial activity once the foundations have been put in order. If, and when, matters improve, it is more than likely that the partial dependence which Europe had upon our market during 1924 and during the earlier part of 1925 will again be restored.

It is unlikely that Europe is capable of much increase in zinc production, due primarily to ore scarcity. To replace the diminished supply of Australian concentrates, which are now all needed for electrolytic zinc output in Tasmania, and for British smelters, the Continental works have been aggressive seekers of fresh ore supplies in many parts of the world. Some imports have been made from this country, and European buyers have appeared intermittently in the Tri-State market. To some extent, therefore, the need of American zinc is offset by ore imports from this continent.

The domestic situation continues sound, current consumption absorbing the entire domestic output. Zinc production is now running at about the same rate as at the beginning of 1925, some 50,000 tons per month, and, whereas during 1925 we exported on an average of 5,500 tons per month, today all of our production of Prime Western spelter is needed here. Stocks have steadily shrunk from 21,000 tons at the beginning of 1925 to around 9,000 tons at the close, or to less than a week's supply at the current rate of domestic consumption. Reports from the chief users of zinc, the galvanizers, brass mills, sheet and strip makers and die casters, all indicate the expectation of a continuance of their current high rate of activity. On the production side there is no present evidence of supplies of Prime Western being raised to a point beyond domestic needs. Some increase in high-grade production is promised for the early part of the year, but the increased demands of the brass mills seem quite adequate to absorb it. Ore stocks in the Tri-State field are low, and ore production there continues to coincide closely

Table II—Silver Shipments to China and India

	To China		To India	
	1924	1925 Eleven Months	1924	1925 Eleven Months
From New York, oz.	.....	.....	81,180,000	60,673,000
From San Francisco, oz.	34,617,000	39,572,000	636,000	.....
From London, value	£368,000	£801,000	£4,446,000	£4,011,000

as much silver during 1925 (see Table II) as she did in 1924. This is accounted for partly by the fact that in 1924 net imports by India were exceptionally large, and partly by the exchange position that has made gold cheaper than silver and therefore in strong demand. However, all reports indicate favorable monsoons, which forecast good crops and accordingly a normal demand for silver in 1926.

The situation in China is more complicated. Conflicting forces are at work. It may be reasoned that warfare cannot be conducted without soldiers, that soldiers will not fight without pay, and that therefore civil strife means increased demand for silver. Or, it may be argued that, when industry is demoralized by warfare, the production of exportable goods is greatly decreased, and consequently that the country cannot buy silver because it has nothing with which to pay for it. Both arguments are sound. However, in 1925 China had a favorable trade balance of about $73,000,000 with the United States, in contrast with an unfavorable balance —a small one, indeed—in 1924. This enabled her to buy silver, which she did. What may happen in 1926 no one knows. The situation at the moment is chaotic. For centuries millions of ounces of silver each year have been poured into China. Most of this still exists. It is not impossible, if conditions get worse, that some of this metal actually may come back in the world market: that China may supply instead of consume silver.

Continental European countries did not take as much silver in 1925 for coinage purposes as they did in 1924. Germany was the leader and some got to Austria and Russia. The demand for small silver coins on the part of the poorer people in European countries is no less insistent, however, and coinage of silver on an increasing scale can be counted on. The potential market in Russia, particularly, is enormous. An important project started in 1925 is a campaign of publicity for silver to be conducted jointly by the American Silver Producers' Association and the Sterling Silverware Manufacturers' Association. They are hopeful of expanding the present market for silver in manufacturing and the arts, which now absorbs only about 30,000,000 oz. of fine silver annually.

Stocks—Table III shows the existence of rather large stocks in the Orient, particularly in China, as of Dec. 1, 1925. However, the supply in India is not abnormal, and

Table III—Stocks of Silver at Various Dates

In Troy Ounces

	Shanghai	India	New York	Canada
Jan. 1, 1923	51,000,000	297,000,000	814,246	682,389
Jan. 1, 1924	45,000,000	297,000,000	345,982	429,210
Jan. 1, 1925	87,000,000	277,000,000	1,060,212	674,850
Dec. 1, 1925	106,000,000	295,000,000	513,000	586,001

December may see a sharp decline in Shanghai. Accordingly these data need not occasion serious apprehension, although they do suggest stagnation in business in China.

Market Prices—The price range at New York for the year was from 66½c. on April 23 and 24 to 72⅞c. on Sept. 5, this being the highest point reached since early in June, 1922. The fluctuations may be ascribed to normal causes. Following the Chinese New Year, in early February, came a brief decline. During the summer and fall, when crops in the Orient must be financed, the price ascended; and the usual year-end slump followed in November and December. This was accompanied by selling from China. Speculative influences, which are so important in the silver market, frequently merely accentuate the fluctuations, for which there are other good reasons.

The improvement of 2.29c. in the average price (66.78c. in 1924 to 69.07c. in 1925) can be accounted for by improved sentiment, and by generally greater prosperity throughout the world; by the slight upward trend of the commodity price level; by the consumption in European countries for coinage; and, perhaps most important, by the demand from China up until the last two months. China looms as the most uncertain and important factor in 1926.

Iron and Steel Close Prosperous Year

Outlook at End Indicates Strong Market in 1926

By B. E. V. Luty
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STEEL PRODUCTION and consumption made a new high record in 1925, in tonnage, but that was only a detail, since the margin of excess was small, and there were more important and satisfactory features of the year, from the standpoint of the producer, the consumer, and the business public.

Steel tonnage in terms of ingot production for the seven post-war years was as follows:

Year	Gross Tons	Year	Gross Tons
1919	33,694,795	1923	43,485,665
1920	40,881,392	1924	36,811,157
1921	19,224,084	1925	44,000,000
1922	34,568,418		

Comparison is naturally made with 1923, hitherto the best post-war year, although one war year, 1917, showed a trifle larger production. As nearly as can be estimated, there were, from 1923 to 1925, decided increases in production of oil-field tubular goods, structural shapes, and sheets and tin plate, and decreases in production of rails, plates, and wire products. Merchant bars probably showed an increase. A feature of production was its steadiness throughout the year. March was the high month and July the low month, with 26½ per cent lower rate. The variation may seem large, but greater changes in the rate of production have occurred in many preceding years.

Steel consumption was much steadier in 1925 than steel production, there having been an excess in the early months of the year, attributable to the fact that buying was unnecessarily heavy. Some of the price advances made early in the year appeared to have been

U. S. Geological Survey, estimated that the refinery production of gold in the United States, including the Philippines, in 1925 amounted to $49,126,900, a decrease of $3,150,100 from that of 1924. With the exception of 1922, this is the lowest production for several decades and is less than one-half the peak production of $101,035,700 in 1915. Notwithstanding the marked increase in Canada, the entire production of North America, estimated in 1925 at $99,200,000, again is less than the production of the United States alone in 1915. Production of gold in Utah in 1925 is estimated at $3,704,100, an increase of $534,500 from that of 1924; in the Philippine Islands, $1,843,200, an increase of $96,500; in New Mexico, $584,400, an increase of $31,600; in Colorado, $7,221,600, a decline of $1,478,300; in Nevada, $3,778,000, a decline of $769,300; in Arizona, $4,136,600, a decline of $543,200; in Alaska, $6,004,100, a decline of $271,000; in Montana, $1,769,900, a decline of $210,800; in Oregon, $371,300, a decline of $199,700; in South Dakota, $5,962,800, a decline of $178,500; in Idaho, $458,100, a decline of $101,800; in Washington, $209,600, a decline of $82,500; and in California, $13,042,200, a decline of $43,500.

The United States produced 21.5 per cent of the world's highest production in 1915, $468,799,812; and has since contributed a continually decreasing percentage, until in 1924 it was 13.4 and in 1925 only 12.6 per cent. Canada in a few years will probably supersede the United States in the production of gold. Unless some constructive remedy be applied to improve domestic conditions, the United States will continue to become a still smaller factor in world production.

The purchasing power of the dollar receded continuously from 99 pre-war (1913) cents in 1915, to 44.2c. in 1920. In 1921, when the deflation took place, the purchasing power of the dollar increased to 68c. The average purchasing power of the dollar for the first eleven months of 1924 was 67c., declining to 63c. in 1925, thereby increasing the cost of production, which is reflected in the general domestic decline.

Imports of gold into the United States declined from $309,446,869 in the first eleven months of 1924, to $121,049,225 for the corresponding period in 1925, and exports of gold from the United States increased from $21,973,660 to $256,666,688. From a net importation of gold in the first eleven months of 1924 of $287,473,209, the tide has turned, resulting in a net loss by exportation for the same period of 1925 of $135,617,463. Notwithstanding this heavy excess exportation, the gold reserves of the Federal Reserve System increased $232,000,000 during the year.

On Jan. 21, 1925, there was $950,000,000 in outstanding credit in the Federal Reserve System, while the amount increased to $1,500,000,000, or 57.9 per cent, at the end of the year. This great credit increase is due largely to the maintenance of a rediscount rate lower than the commercial rate, thereby encouraging the excessive use of Federal Reserve credit, which in turn is principally accountable for the decline in the purchasing power of the dollar in 1925. Under the present system, the control of the rediscount rate is political rather than economic. The public welfare and prosperity, as well as the condition of the gold-mining industry, are dependent to an important degree upon price stability and protection from inflation, which cannot be accomplished unless the determination of the rediscount rate is predicated upon economic considerations. The inflation now begun will be difficult to check, and it therefore would seem probable that the purchasing power of the dollar will still further decline in 1926 and result in a lessened production of gold in the United States.

Silver Production Is Lower

Better Prices in 1925—China Now Uncertain Factor

By Arthur B. Parsons
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WORLD PRODUCTION of silver declined about 3 per cent in 1925. China, in spite of internal strife, absorbed an increased quantity more than sufficient to offset a decline in the takings of India as compared with 1924; non-liquid stocks in the Orient increased; the average price was 2.29c. higher than that of 1924; and, in so far as there is any rhyme or reason in seasonal fluctuations in price, those of 1925 were entirely normal. Such are the features of the silver market during 1925.

Supplies—Table I shows a probable decrease in the output of new metal in the three principal producing countries, the largest decline being in Canada. Incidentally, the Canadian Government estimates show a much smaller decrease. This decline in the world's output is important because the high rate of lead and zinc production during the year tended to increase silver production, as did the comparatively high price for silver itself. That output did not increase is significant because it makes it reasonable to infer that no great increase in production is to be anticipated during 1926; unless, of course, something should cause the price to rise sharply to a point that would stimulate new production. A potential source of increased output is in the operation of the high-silver copper mines at greater capacity. Apparently, the secondary production from scrap and from coins, for the re-minting of debased issues, that was so important in 1922 and 1923, is no longer a factor of great moment.

Table I—World's Production of Silver*

In Troy Ounces

Source	1921	1922	1923	1924	1925
United States....	53,052,441	56,240,049	66,163,338	64,221,655	61,200,000
Canada.....	13,543,198	18,626,439	18,601,744	20,243,846	15,700,000
Mexico.....	64,465,347	81,076,899	90,810,855	91,437,944	88,900,000
Peru.....	9,853,910	13,169,765	18,654,362	18,800,000	21,600,000
Rest of World....	30,958,350	41,420,351	45,821,715	46,232,244	46,200,000
Total.....	171,873,246	210,533,502	240,052,014	240,935,689	233,600,000

* Figures prior to 1925 from American Bureau of Metal Statistics; those for 1925 estimated from the Bureau's figures for 11 months.

Oriental Consumption—The demand from China and India always is the dominant factor in the silver market. India—judging from the imports only, as figures of export are not available—apparently has not taken

for the purpose of inducing anticipatory buying. Afterward, when the market lost certain advances that had been practically "on paper," an unfavorable appearance was presented. Mills have since concluded that such a policy was inadvisable, and late in 1925, with heavy demand, price policies were dictated with a view to the maintenance of a steady demand. Prices on some steel products were quite satisfactory, though on others they were distinctly unsatisfactory; yet, with the large tonnage, the financial results as a whole were fairly good.

An important feature of the year was its strong finish. Production and shipments in the last three months were not much under the record high for any three consecutive months since the war, yet there was no evidence of any considerable amount of stocking by buyers; hence a very high rate of consumption was indicated, and there is no reason to expect any decrease in 1926.

One of the most important features of the steel trade in 1925 with reference to distributers and manufacturing consumers, as well as to producers, was the smoothness with which all operations were conducted. Another long-range view, from a different angle, is the interesting comparison that, omitting 1922, production of steel in the three years, 1923, 1924, and 1925 was one-third greater than production in the first three post-war years, ample testimony to the incorrectness of the view held late in the war, by many observers, that there was "a pent-up demand for steel" which would be released at once. What is plain now is that people had first to get down to hard and efficient work before steel could be consumed in quantity.

Besides acting as a barometer of general trade, steel indicates varying degrees of activity in different consuming lines. Thus, again taking for comparison 1923, as a year of substantially the same total tonnage as 1925, there was a large decrease in steel consumption by railroads, an increase in consumption of tubular goods by the oil and gas fields, a large increase in construction involving fabricated structural steel, no material change in consumption by the automobile industry, and a large increase in agricultural-implement manufacture. The large decrease in freight-car building was partly due to the fact that the railroads had already done much in rehabilitating rolling stock and in part to greater efficiency in their use of cars and locomotives. For 1926 greater activity in track and terminal work is promised. The statistical position of oil, as to production, stocks, and prices, was not such in 1925 as to stimulate drilling to any particular degree, but offsetting is always a factor, and there was much laying of gas lines.

Of general interest is the steady increase in the use of fabricated structural steel. Though 1924 was an off year, in a mild way, as to steel in general, there was an increase even in that year in contracts let for fabricated structural steel work. Including an estimate for December, 1925, lettings were as follows, in net tons: 1923, 2,185,950; 1924, 2,363,500; 1925, 2,600,000.

Production of agricultural implements in 1925 was the largest for several years, and the industry also had favorable conditions, in that, with its more diversified activities, it had a steadier and less "seasonal" operation than was formerly the case.

The year closed with no poor outlook in any line and no indication that any important industry, with the possible exception of the much-vexed one of automobile production, had in 1925 overdone its normal activity.

Tin in Interesting Position

Stocks in England and United States Greatly Depleted

By J. H. Lang
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THOUGH the tin market in 1925 was somewhat steadier and more orderly than at times in the past, it was not devoid of the usual erratic fluctuations, as is shown by the following table:

Spot Straits	London £	s.	d.	New York Cents
Opening	277	10	–	60
High, Nov. 13	296	15	–	64½
Low, April 16	235	—	–	50⅛
Closing	290	2	6	63¾

The 1923 range was from 37 to 51c. and in 1924 from 40 to 59c. A persistent tendency to establish itself on higher levels is manifested by these figures, partly due, so far as United States prices are concerned, to higher rates for sterling exchange, which at present are 30 to 40c. to the pound sterling above the average for the two preceding years. Assuming previous price levels (outside of war times) to represent a fair average of values, some advance is warranted by the fact that for the last four years consumption of the metal has exceeded production and still exceeds it. Roughly speaking, and without attempting to quote exact figures, there were in the world, *visible* and *invisible*, at the end of 1921, stocks of about 50,000 tons of tin, which have now shrunk to 18,000. In other words, consumption has exceeded production during these four years by more than 30,000 tons, and this in spite of continuous and persistent efforts to expand the output with every incentive in the way of high prices to help.

Supplies and Deliveries of Tons in 1925 and 1924

	1925 Tons	1924 Tons	Increase Tons	Decrease Tons
Supplies				
Straits	78,952	78,695	257	.....
Australian	1,186	1,608	.....	422
Banka and Billiton	14,177	15,098	.....	921
Chinese	7,421	7,534	.....	113
Standard	17,928	13,825	4,103	.....
	119,664	116,760	2,904	.....
Deliveries				
United Kingdom	18,977	18,278	699	.....
Continent	31,296	30,280	1,016	.....
Total Europe	50,273	48,558	1,715	.....
United States	76,455	64,125	12,330	.....
Grand total	126,728	112,683	14,045	.....
Visible supply Jan. 1	25,088	21,011	4,077	.....
Visible supply Dec. 31	18,024	25,088	.....	7,064
Decrease visible	7,064	Inc. 4,077	11,141	.....
Decrease invisible	.....	Dec. 9,680	.....	9,680
Total stocks decrease	7,064	5,603	1,461	.....

To read the foregoing table understandingly one

must bear in mind that Straits and Banka supplies ex Bandoeng pool in 1924 were 7,480 and 2,200 tons respectively. Freed from the distortion of the Bandoeng liquidation, supplies, presumably ex production from the Straits, were as follows: 1923, 62,545; 1924, 71,215; 1925, 78,952 tons.

In the last pre-war year, 1913, Straits shipments were 62,467 tons. The relatively stability of Straits shipments after this lapse of eleven years (1913-1923), and the sudden rise in 1924 and 1925, are the outstanding features here. The increase has been partly due to increased mining operations in the Straits and partly to larger imports from other countries smelted in the Straits. However derived, it was a fortunate occurrence for the market. In spite of it, and in spite of the fact that deliveries during the last eight months of the year were 1,500 tons per month smaller than during the first four months, the year was closed with 7,000 tons less on hand than at the beginning.

Production of other countries (smelted elsewhere than in the East Indies) remains about the same, as shown by the accompanying table.

Tin Production in Miscellaneous Countries

	1925 (a) Tons	1924 Tons	1923 Tons
Nigeria	6,000	6,196	5,935
China	7,000	7,434	8,568
Bolivia	30,000	29,447	28,683
Cornwall	2,500	1,986	1,021
Transvaal	1,500	1,245	850
	47,000	46,308	45,057

(a) One month estimated.

Such of this production (except Chinese) as is included in Statistics appears under the head of Standard tin, as follows: in 1925, 17,928 tons; 1924, 13,825 tons.

It will be seen that, though more Standard tin appeared in statistics in 1925, production of ores from which it is derived, was practically unchanged. The apparent increase in 1925 arises chiefly from a transfer of smelting operations from Germany to the United Kingdom. When the ores or concentrates were shipped to Germany and smelted there, the tin was not included in Statistics. Now it is—at least to a somewhat larger extent than formerly, though the figures still fall short about 20,000 tons of accounting for the world's total production.

European deliveries continue to expand but slowly and are still below the pre-war level. Of the 50,273 tons shown as delivered outside the United States in 1925, the United Kingdom and the Continent combined took 40,152 tons, and other countries 10,121 tons. In 1913 the United Kingdom and Continent combined took 44,062 tons (Ricard's Statistics). In the twelve years which have since elapsed the United States has increased its consumption from 45,000 tons per annum to 76,000 tons per annum, or 70 per cent, while Europe last year actually took 9 per cent less than in 1913. If these war-worn countries should stage a come-back a very tight position is impending; in fact, if the United States should take as much tin in the early part of 1926 as it did in 1925, the situation is likely to be somewhat strained, even if there is no change in Europe.

On the other hand, there are fair prospects that the East Indies and South America will produce more. A larger production from both sources is predicted. The pinch, if it comes, is likely to occur in the early part of the year, when deliveries are usually larger and supplies smaller than at other periods. Practically the whole of last year's decrease took place between January and April. Next spring the *Visible* cannot stand such a drain. The year, as a whole, may bring forth more tin, or the United States may consume less, but neither of these contingencies is likely to be operative to any extent during the next four months. There are now no reserve stocks which can be drawn upon as has been done during the last four years. Stocks in England and in the United States are already down to a point which causes spot and near-by deliveries to sell at substantial premiums. At best the position is closely balanced and will bear careful watching.

Yearly Average Prices of Principal Metals, 1895-1925

Prices in New York or St. Louis, cents per pound, except quicksilver (dollars per flask); silver and platinum (dollars per ounce). London quotations, pounds sterling per long ton.

	Copper		Lead		Tin		Zinc			Anti-mony,	Quick-silver,	Silver,	Plat-inum,
	Electrolytic	Standard											
Year	New York	London	New York	London	(*f*) New York	(*a*) London	New York	St. Louis	London	New York	New York	New York	New York
1895	10.76(*b*)	.....	3.23	.....	14.05	63.333	3.63	.....	.....	7.560	39.58	65.250	.....
1896	10.88(*b*)	.....	2.98	.....	13.29	59.496	3.94	.....	.....	6.650	37.00	67.060	.....
1897	11.29(*b*)	.....	3.58	12.367	13.67	61.400	4.12	.....	.....	6.750	38.50	59.790	.....
1898	12.03(*b*)	.....	3.78	12.983	15.70	71.204	4.57	.....	.....	8.690	40.70	58.260	.....
1899	16.67	.....	4.47	14.933	25.12	122.429	5.75	.....	.....	9.430	43.63	59.580	15.22
1900	16.19	.....	4.37	16.987	29.90	133.575	4.39	.....	.....	9.500	51.00	61.330	18.09
1901	16.11	.....	4.33	12.521	26.74	118.633	4.07	.....	.....	8.250	47.00	58.950	20.00
1902	11.626	52.460	4.069	11.262	26.79	120.720	4.84	.....	.....	6.120	48.03	52.160	19.00
1903	13.235	57.970	4.237	11.579	28.09	127.320	5.40	5.191	.....	6.000	41.32	53.570	18.91
1904	12.823	58.884	4.309	11.983	27.99	126.733	5.100	4.931	.....	6.371	41.00	57.221	19.50
1905	15.590	69.465	4.707	13.719	31.358	143.083	5.882	5.730	25.433	10.250	38.50	60.352	20.34
1906	19.278	87.282	5.657	17.370	39.819	180.646	6.198	6.048	27.020	21.730	40.90	66.791	28.04
1907	20.004	87.007	5.325	19.034	38.166	172.638	5.962	5.812	23.771	14.840	41.50	65.237	30.98
1908	13.208	59.902	4.200	13.439	29.465	133.124	4.726	4.578	20.163	8.004	44.84	52.864	16.32
1909	12.982	58.732	4.273	13.042	29.725	134.774	5.503	5.352	22.185	7.466	46.30	51.502	24.87
1910	12.738	57.054	4.446	12.920	34.123	155.308	5.520	5.370	23.050	7.386	47.06	53.486	32.70
1911	12.376	55.973	4.420	13.970	42.281	192.353	5.758	5.608	25.281	7.540	46.54	53.340	43.12
1912	16.341	72.942	4.471	17.929	46.096	209.420	6.943	6.799	26.421	7.760	42.46	60.835	45.55
1913	15.269	68.335	4.370	18.743	44.252	201.679	5.648	5.504	22.746	7.520	39.54	59.791	44.88
1914	13.602	61.524(*c*)	3.862	19.076(*c*)	34.301	156.564(*c*)	5.213	5.061	22.544(*c*)	8.763	48.31	54.811	45.14
1915	17.275	72.532	4.673	22.917	38.590	163.960	13.230	13.054	67.533	30.280	87.01	49.684	47.13
1916	27.202	116.059	6.858	31.359	43.480	182.096	12.804	12.634	72.071	25.370	125.49	65.661	83.40
1917	27.180	124.892	8.787	30.500	61.802	237.563	8.901	8.730	52.413	20.690	106.30	81.417	102.82
1918	24.628(*d*)	115.530	7.413	30.100	(*e*)	330.138	8.159	7.890	54.180	12.581	123.47	96.771	105.95
1919	18.691	90.796	5.759	28.590	63.328	257.601	7.338	6.988	42.879	8.190	92.15	111.122	114.61
1920	17.456	97.480	7.957	37.832	48.273	295.866	(*e*)	7.671	44.372	8.485	81.12	100.900	110.90
1921	12.502	69.356	4.545	22.752	28.576	165.265	(*e*)	4.655	25.845	4.957	45.46	62.654	75.03
1922	13.382	62.123	5.734	24.097	31.831	159.450	(*e*)	5.716	30.003	5.471	58.946	67.521	97.618
1923	14.421	65.840	7.267	27.147	41.799	202.148	(*e*)	6.607	33.058	7.897	66.502	64.873	116.537
1924	13.024	63.149	8.097	34.421	49.674	248.737	(*e*)	6.344	33.728	10.836	69.761	66.781	118.817
1925	14.042	61.920	9.020	36.429	56.790	260.974	(*e*)	7.622	36.624	17.494	83.128	69.065	119.093

(a) Prices of tin, London, from 1895 to 1914 from statistical report of Metallgesellschaft, Frankfurt-am-Main. (*b*) Prices 1895 to 1898 are for Lake copper. (*c*) Averages for nine months, no quotations being made during August, September and October. (*d*) Average of eleven months, no quotations being made in December. (*e*) No average computed. (*f*) 99 per cent tin.

Iron-Ore Production in United States[1]

District	Ore Mined, Gross Tons 1924	Ore Mined, Gross Tons 1925	Ore Shipped 1924 Gross Tons	Ore Shipped 1924 Value	Ore Shipped 1925 Gross Tons	Ore Shipped 1925 Value
Lake Superior						
Michigan	12,350,755	14,500,000	11,248,641	$35,605,902	15,218,000	$40,172,000
Minnesota	31,902,085	37,000,000	31,076,114	93,311,092	37,970,000	95,608,000
Wisconsin	690,058	816,000	786,006	2,044,752	936,000	2,281,000
	44,942,898	52,316,000	43,110,761	$130,961,756	54,124,000	$138,061,000
Southeastern States:						
Alabama	6,993,613	7,125,000	6,557,596	13,927,551	6,896,000	14,698,000
Georgia	113,039	111,000	112,059	285,128	112,000	314,000
Missouri	79,847	40,000	79,847	405,622	40,000	148,000
North Carolina	12,525	24,000	12,525	32,512	24,000	53,000
Tennessee	179,853	133,000	179,293	431,682	133,000	282,000
Virginia	89,792	77,000	91,759	250,279	57,000	128,000
	7,468,669	7,510,000	7,033,079	$15,332,774	7,262,000	$15,623,000
Northeastern States:						
New Jersey	65,197	202,000	101,123	420,488	163,000	730,000
New York	255,832	134,000	303,386	1,448,616	394,000	1,892,000
Ohio	244	2,000	244	1,881,366	2,000	1,460,000
Pennsylvania	807,208	964,000	807,411		923,000	
	1,128,431	1,302,000	1,212,164	$3,750,470	1,482,000	$4,082,000
Western States	727,371	951,000	727,371	$1,262,105	951,000	$1,597,000
Grand total	54,267,419	62,079,000	52,083,375	$151,307,105	63,819,000	$159,363,000

[1]Estimates of ore mined and shipped in 1925 and actual output in 1924. Data from Bureau of Mines.

U. S. Refinery Production of Gold and Silver in 1925[a]

State	Gold Ounces	Gold Value	Silver Ounces	Silver Value
Alaska	290,448	$6,004,100	647,432	$449,318
Arizona	200,108	4,136,600	7,144,949	4,958,595
Arkansas	.....	.....	1,600	1,110
California	630,916	13,042,200	3,070,305	2,130,792
Colorado	349,345	7,221,600	4,398,854	2,990,345
Georgia	498	10,300	51	35
Idaho	22,161	458,100	7,603,245	5,276,652
Illinois	.....	.....	3,674	2,550
Michigan	.....	.....	131,053	90,951
Missouri	.....	.....	45,841	31,814
Montana	85,619	1,769,900	12,857,351	8,923,002
Nevada	182,761	3,778,000	7,020,952	4,872,541
New Mexico	28,270	584,400	754,108	523,351
North Carolina	905	18,700	102	71
Oregon	17,962	371,300	29,203	20,267
Pennsylvania	116	2,400	1,399	971
South Dakota	288,450	5,962,800	101,862	70,692
Tennessee	363	7,500	107,215	74,407
Texas	.....	.....	570,000	395,580
Utah	179,186	3,704,100	21,110,997	14,651,032
Virginia	5	100	5	3
Washington	10,139	209,600	166,719	115,703
Wyoming	10	200	100	69
Porto Rico	87	1,800	195	135
Philippine Islands	89,165	1,843,200	45,508	31,582
Totals	2,376,514	$49,126,900	65,722,720	$45,611,568

(*a*) Data from Bureau of Mint in co-operation with U.S. Bureau of Mines. Silver valued at 69.4c., average New York price.

Copper Production of Important Countries[a]

In tons of 2,000 Pounds

Country	1920	1921	1922	1923	1924	1925
United States	635,248	238,420	511,970	754,000	819,000	954,000
Mexico	49,866	13,576	29,842	60,538	49,150	35,700
Canada	39,121	22,632	25,300	40,230	51,008	26,700
Chile	109,075	65,299	124,830	201,042	209,855	235,000
Peru	36,356	36,689	40,133	48,684	38,495	
Japan	74,727	59,626	59,663	70,316	69,378	72,100
Australia	29,327	20,869	13,754	19,995	15,711	12,300
Europe	52,923	76,687	85,848	113,949	118,761	107,000
Africa	33,708	42,501	58,219	80,410	114,700	103,100

(*a*) Figures from American Bureau of Metal Statistics; estimates for 1925 based on eleven months' production.

Production of U. S. Lead Refineries[a]—1920-1925

In Tons of 2,000 Pounds

Domestic	1920	1921	1922	1923	1924	1925[b]
Desilverized	236,912	202,649	210,039	305,861	299,343	345,000
Antimonial	8,992	5,419	6,265	15,848	19,700	16,000
S. E. Missouri	206,836	142,804	203,327	182,221	267,064	306,000
S. W. Missouri	29,004	56,155	63,666	76,644		
Totals	471,744	406,896	483,297	580,574	586,107	667,000
Foreign						
Desilverized	51,700	47,697	66,781	64,727	122,999	112,000
Antimonial	2,197	2,391	1,126	1,035	1,087	1,000
Totals	53,897	50,058	67,907	65,762	124,086	113,000
Grand totals	525,641	456,954	551,204	646,336	710,193	780,000

(*a*) Including lead derived from scrap and junk by primary smelters.
(*b*) Bureau of Mines estimate.

Production of Lead in Principal Countries[a]

In Tons of 2,000 Pounds

Country	1920	1921	1922	1923	1924	1925
United States	431,940	365,129	426,384	480,816	535,248	573,000
Mexico	85,209	60,647	120,821	167,144	161,347	205,000
Canada	16,499	31,190	41,588	48,897	78,548	124,000
Spain and Tunis	186,503	148,481	132,315	141,806	155,736	128,000
Italy	15,947	12,486	10,850	17,132	22,061	15,400
Australia	6,933	57,218	107,108	124,607	127,593	166,000
Burma	24,203	34,235	39,843	46,484	52,589	52,800
Rhodesia	14,835	17,970	20,831	11,198	6,353	3,500

(*a*) Figures from American Bureau of Metal Statistics; 1925 estimates based on eleven months.

Metal and Mineral Output of British Columbia

Department of Mines, British Columbia

	1924 Quantity	1924 Value	1925 Quantity	1925 Value	Increase
Gold, placer, oz.	21,037	$420,750	19,351	$400,000	(*a*) $20,750
Gold, lode, oz.	247,716	5,120,535	214,109	4,425,631	(*a*) 694,904
Total gold	268,753	$5,541,285	233,460	$4,825,631	(*a*) $715,654
Silver, oz.	8,341,768	$5,292,184	7,303,755	$5,044,703	(*a*) 247,481
Lead, lb.	170,384,481	12,415,917	236,408,000	18,581,668	6,165,751
Copper, lb.	64,845,393	8,442,870	71,803,000	10,109,862	1,666,992
Zinc, lb.	79,130,970	4,266,741	97,722,000	7,720,038	3,453,297
Total metalliferous	.....	$35,958,997	.....	$46,281,902	$10,322,905
Coal tons (2,240 lb.)	1,939,526	9,697,630	2,329,164	11,645,820	1,948,190
Coke tons (2,240 lb.)	30,615	214,305	80,554	563,878	349,573
Building materials	.....	2,833,672	.....	3,000,000	166,328
Total value of production	.....	$48,704,604	.....	$61,491,600	$12,786,996

Approximate tonnage treated: 3,750,000 tons.
(*a*) Decrease.

Output of Ontario Gold Mines in 1925

Source and Period	Ore Milled, Tons	Total Value Crude Bullion
Porcupine		
January-June (six months)	1,485,033	$11,950,025
July	248,817	2,163,463
August	263,119	2,267,095
September	238,744	2,109,360
October	237,163	1,893,651
November	242,797	1,874,809
Total	2,715,673	$22,258,403
Kirkland Lake		
January-June (six months)	183,079	2,628,608
July	32,812	515,322
August	32,371	434,109
September	26,375	451,912
October	34,923	460,149
November	35,212	459,353
Total	344,772	$4,949,453
Miscellaneous	131	2,114
Total for 11 months	3,060,576	$27,209,970

Producing mines during November in order of output were as follows:
Porcupine: Hollinger, Dome, McIntyre, Vipond, Consolidated West Dome Lake, Night Hawk Peninsular.
Kirkland Lake: Wright-Hargreaves, Lake Shore, Teck-Hughes, Tough-Oakes-Burnside, Argonaut, Barry Hollinger.

Mining Dividends in 1924 and 1925

North and South American Companies

Company Name	Situation	Shares Issued	Par Value	1924 Per Share	1924 Total	1925 Per Share	1925 Total	Total Paid to End of 1925	Latest Dividend Paid Date	Per Share
United States										
*Alaska Treadwell Gold	Alaska	200,000	$25	$1.00	$200,000	.....	.....	.....	Nov., 1924	$1.00
American Metal	Various	593,458	No	3.00	1,773,395	$3.25	$1,926,775	.....	Dec., 1925	1.00
American Metal, pfd	Various	50,000	100	7.00	350,000	7.00	350,000	.....	Dec., 1925	1.75
American Smelting & Refining	Various	609,980	100	5.00	2,049,900	6.25	3,812,375	$143,663,191	Nov., 1925	1.75
American Sm. & Ref., pfd	Various	500,000	100	7.00	3,500,000	7.00	3,500,000		Dec., 1925	1.75
*Anaconda Copper Mining	Various	3,000,000	50	.75	2,250,000	3.00	9,000,000	184,958,750	Nov., 1925	.75
Arizona Commercial, c	Ariz.	265,000	5	1.00	265,000	1.00	265,000	1,749,000	July, 1925	.50
*Barnes King Development, g	Mont.	400,000	5	.....	.....	.60	240,000	.....	Apr., 1925	.60
*Bethlehem Steel	Various	1,801,519	100	3.75	6,755,696	.....	.....	.....	July, 1924	1.25
*Bethlehem Steel, 7% pfd	Various	481,943	100	7.00	3,132,241	7.00	3,373,601	.....	Oct., 1925	1.75
*Bethlehem Steel, 8% pfd	Various	116,606	100	8.00	1,172,024	8.00	932,848	.....	Oct., 1925	2.00
Bingham Mines, s, l	Utah	50,000	10	.....	.....	2.50	167,375	842,375	Dec., 1925	1.00
Bunker Hill & Sullivan, l, s	Idaho	327,000	10	6.00	1,962,000	9.00	2,943,000	33,777,000	Dec., 1925	.75
Bunker Hill & Sullivan, pfd	Idaho	3,756	100	.....	.....	.....	16,210	16,210	Oct., 1925	.....
Butte Copper & Zinc, z, l, s, m	Mont.	600,000	5	.50	300,000	.50	300,000	1,200,000	Dec., 1925	.50
Butte & Superior, z, c	Mont.	290,198	10	.....	.....	2.00	580,395	17,955,949	Dec., 1925	.50
California Rand Silver, s, g	Calif.	1,280,000	1	.33	422,400	.54	691,200	3,948,800	Dec., 1925	.02
Calumet & Arizona, c, s, g	Ariz.	642,757	10	2.00	1,285,063	4.00	2,571,028	54,305,500	Dec., 1925	1.50
*Calumet & Hecla Con. Copper	Mich.	2,005,502	25	.50	1,002,751	1.50	3,008,253	182,158,253	Dec., 1925	.50
*Cardiff Mining & Milling, s, l	Utah	500,000	1	.20	100,000	.....	.....	1,025,000	Nov., 1924	.10
Champion Copper	Mich.	100,000	25	7.80	780,000	6.40	640,000	28,570,261	Apr., 1925	6.40
Chief Consolidated, s, l	Utah	1,138,705	1	.20	199,276	.20	214,193	3,083,574	Nov., 1295	.10
Cleveland Cliffs Iron	Mich., W. Va.	400,000	No	3.00	1,200,000	3.00	1,200,000	.....	Oct., 1925	.75
*Colorado Fuel & Iron, pfd	Colo., Wyo.	20,000	100	8.00	160,000	8.00	160,000	.....	Nov., 1925	2.00
*Consolidated Lead & Zinc	Kans.	.....	20	.....	.....	.....	.....	.....	Dec., 1925	.20
Copper Range	Mich.	394,727	25	1.00	394,727	1.00	394,727	28,576,646	May, 1925	1.00
Cresson Cons. Gold M. & M	Colo.	1,220,000	1	.40	488,000	.40	488,000	10,776,272	Oct., 1925	.10
*Davis-Daly Copper	Mont.	600,000	10	.....	.....	.80	480,000	1,380,000	Feb., 1925	.80
Eagle Picher Lead, l, z	Okla., Kans., Mo.	1,000,000	20	1.40	1,400,000	1.60	1,600,000	.....	Dec., 1925	.40
Eagle Picher Lead, pfd	Okla., Kans., Mo.	8,553	100	6.00	53,353	6.00	51,480	.....	Oct., 1925	1.50
*Federal Mng. & Smg., pfd., s, l, z	Ida., Kans., Mo.	120,000	100	7.00	840,000	7.00	840,000	19,502,871	Dec., 1925	1.75
*General Development	Various	120,000	25	1.00	120,000	1.00	120,000	.....	Nov., 1925	.25
*Gladstone Mountain Mng., l	Wash.	1,321,890	0.10	.....	.....	.05	66,094	66,094	Dec., 1925	.005
Golden Cycle M. & R., g	Colo.	1,500,000	1	.12	180,000	.12	180,000	10,233,300	Dec., 1925	.03
*Great Northern Iron Ore	Minn.	1,500,000	No	4.00	6,000,000	1.75	2,625,000	54,750,000	Dec., 1925	.75
*Great Western Mines	Nev.	1,330,000	.10	.03	39,900	.....	.....	39,900	Nov., 1924	.01
Hecla Mining, l, s	Idaho	1,000,000	.25	1.00	1,000,000	2.00	2,000,000	14,105,000	Dec., 1925	.50
*Hercules Mining, l, s	Idaho	.....	.....	.....	550,000	.....	.....	.....	.....	.....
*Homestake Mining, g	S. D.	251,160	100	7.00	1,758,120	7.00	1,758,120	48,889,714	Dec., 1925	.50
Inland Steel	Minn.	1,182,799	No	2.50	2,956,998	2.50	2,956,998	.....	Dec., 1925	.625
Inland Steel, pfd	Minn.	100,000	$100	7.00	700,000	7.00	700,000	.....	Oct., 1925	1.75
Inspiration Consol. Copper	Ariz.	1,181,967	20	.50	590,983	1.00	1,181,967	42,529,602	Oct., 1925	.50
Iron Blossom Consol., s, l, g	Utah	1,000,000	.10	.05	50,000	.....	.....	3,525,000	Oct., 1924	.025
Isle Royale Copper	Mich.	150,000	25	.....	.....	1.00	150,000	2,550,000	Dec., 1925	1.00
Jardine Mining, g, a	Mont.	2,184,380	1	.....	.....	.01	21,844	21,844	Oct., 1925	.005
Kennecott Copper	Alaska	4,474,281	No	3.00	9,839,612	3.00	13,044,699	88,376,793	Oct., 1925	.75
Keystone Mining, l, s	Utah	900,000	$1	.....	.....	.075	67,500	67,500	Aug., 1925	.075
Magma Copper	Ariz.	408,155	No	.....	.....	1.50	612,232	2,316,232	Oct., 1925	.75
Mammoth Mining, l, s, c, g	Utah	400,000	.10	.....	.....	0.20	79,063	2,899,063	Dec., 1925	.10
Miami Copper	Ariz.	747,114	$5	2.00	1,494,228	1.25	993,892	29,861,464	Nov., 1925	.25
Mother Lode Coalition, c, s	Alaska	2,500,000	No	.75	1,875,000	.75	1,875,000	8,750,000	Dec., 1925	.375
*Mohawk Mining, c	Mich.	115,000	$25	.....	.....	4.00	460,000	10,780,000	Dec., 1925	1.00
*National Lead	Various	206,554	100	8.00	1,652,432	8.00	1,652,432	17,298,897	Dec., 1925	2.00
*National Lead, pfd	Various	243,676	100	7.00	1,705,732	7.00	1,705,732	30,703,176	Dec., 1925	1.75
Nevada Consol. Copper	Nev.	1,999,457	5	.....	.....	.25	499,864	47,268,481	Dec., 1925	.25
New Cornelia Copper	Ariz.	1,800,000	5	.75	1,350,000	1.00	1,800,000	7,650,000	Nov., 1925	.25
New Jersey Zinc	Various	490,816	100	10.00	4,908,160	12.00	5,889,792	.....	Dec., 1925	2.00
Newmont Mining	Various	430,000	10	.....	.....	1.30	558,000	558,000	Oct., 1925	.60
*Nichols Copper, pfd	N. Y.	23,105	100	.....	.....	7.00	161,735	.....	Oct., 1925	1.75
*Night Hawk Leasing, c	Ariz.	.....	.....	.....	.....	.....	.....	.....	Dec., 1925	.50
Ohio Copper	Utah	2,899,335	1	.05	144,657	.05	144,977	289,633	Dec., 1925	.05
*Park City Mng. & Smg., s, l, z	Utah	876,000	5	.60	525,600	.45	394,200	1,358,200	July, 1925	.15
*Park-Utah Consol, s, l, z	Utah	2,000,000	1	.....	.....	.15	300,000	300,000	Oct., 1925	.15
*Park-Utah Mining, s, l	Utah	1,000,000	1	.30	300,000	.....	.....	1,296,037	Apr., 1924	.15
*Phelps-Dodge, c	Ariz.	500,000	100	4.00	2,000,000	4.00	2,000,000	101,675,000	Oct., 1925	1.00
*Republic Iron & Steel, pfd	Mich., Ala.	250,000	100	10.00	2,500,000	7.00	1,750,000	.....	Oct., 1925	1.75
St. Joseph Lead	Mo.	1,936,637	10	2.00	3,098,758	3.00	5,615,973	36,200,399	Dec., 1925	1.50
St. Mary's Mineral Land, c	Mich.	160,000	25	3.00	480,000	3.00	480,000	.....	May, 1925	3.00
Silver King Coalition, s, l	Utah	1,216,100	5	.60	729,660	1.00	1,216,100	22,846,860	Dec., 1925	.10
*Silver Wave Mining, s	Utah	647,500	.01	.001	647	.....	.....	3,885	Sept., 1924	.001
*Sloss-Sheffield Steel & Iron	Ala.	100,000	$100	6.00	600,000	6.00	600,000	.....	Dec., 1925	1.50
*Sloss-Sheffield S. & I., pfd	Ala.	67,000	100	7.00	469,000	7.00	469,000	.....	Oct., 1925	1.75
*Superior Copper	Mich.	100,000	25	.....	.....	2.49	249,000	649,000	Feb., 1925	2.49
*Tamarack & Custer	Idaho	5,000,000	1	.04	200,000	.....	.....	1,121,992	Sept., 1924	.02
Tecopa Consol. Mining, l	Calif.	3,000,000	1	.01	30,000	.....	.....	330,000	Apr., 1924	.01
Tennessee Copper & Chemical	Tenn.	794,611	No	0.25	198,609	.50	397,300	1,584,553	Dec., 1925	.25
Texas Gulf Sulphur	Texas	635,000	$10	7.50	4,762,500	8.75	5,556,250	18,097,500	Dec., 1925	2.75
Tintic Standard Mining, s, l	Utah	1,152,915	1	1.00	1,149,000	1.70	1,959,955	5,552,713	Dec., 1925	.50
Tomboy Gold Mines	Colo.	310,000	£1	9d.	£11,625	1s.10d.	£22,194	£882,818	Sept., 1925	1s.
Tonopah Extension, s, g	Nev.	1,477,716	$1	$0.20	$278,543	$0.10	$143,522	$3,927,221	Apr., 1925	$0.05
Tonopah Mining, s, g	Nev.	1,000,000	1	.15	150,000	.65	650,000	16,275,000	Oct., 1925	.075
Tonopah Belmont Dev., s, g	Nev.	1,500,000	1	.....	.....	.10	150,000	10,943,063	Oct., 1925	.05
*Tom Reed Gold Mines	Ariz.	909,555	1	.....	.....	.....	.....	.....	Dec., 1925	.....
Union Copper Land & Mng	Mich.	80,000	25	.50	40,000	.50	40,000	640,000	Nov., 1925	.50
*United Eastern Mining, g, s	Ariz., Mex.	1,363,000	1	.30	408,900	.....	.....	5,997,200	July, 1924	.05
United Gold Mines	Colo.	5,000,000	.10	.01	50,000	.02	100,000	709,179	Aug., 1925	.01
U. S. Smelting, Ref. & Mng., l, s	Various	351,115	$50	.....	.....	2.25	790,009	49,498,177	Oct., 1925	.75
U. S. Smelting, R. & M., pfd	Various	486,350	50	3.50	1,702,225	3.50	1,702,225		Oct., 1925	.875
U. S. Steel	Minn.	5,083,025	100	7.00	35,581,175	7.00	35,581,175	631,544,001	Dec., 1925	1.75
U. S. Steel, pfd	Minn.	3,602,811	100	7.00	25,219,677	7.00	25,219,677	647,709,784	Nov., 1925	1.75
*United Verde Copper	Ariz.	300,000	No	11.00	3,330,000	6.00	1,800,000	68,512,500	Sept., 1925	2.00
United Verde Extension, c	Ariz.	1,050,000	.50	2.50	2,625,000	2.25	2,362,500	24,255,000	Nov., 1925	.75
*Utah Apex Mining	Utah	528,200	$5	.25	132,050	1.30	686,660	1,961,660	Oct., 1925	.35
*Utah Copper	Utah	1,624,490	10	4.00	6,497,960	4.25	6,904,082	138,719,869	Dec., 1925	1.25
Vanadium Corporation	Various	378,367	No	.....	.....	1.00	377,227	2,068,808	Nov., 1925	.50
*Virginia Iron, Coal & Coke	Va., Ky.	100,000	$100	1.50	150,000	.....	.....	.....	Jan., 1924	1.50
*Virginia I. C. & C., pfd	Va., Ky.	50,000	100	5.00	250,000	5.00	250,000	.....	July, 1925	2.50
Yellow Pine Mining	Nev.	1,000,000	1	.16	160,000	.16	160,000	3,020,000	Dec., 1925	.04
Foreign										
Ahumada Lead, l, s	Mex.	1,192,018	1	.525	654,360	.90	1,072,816	1,727,176	Oct., 1925	.25
Amparo Mining, g, s	Mex.	2,000,000	1	.10	200,000	.10	200,000	4,932,177	Nov., 1925	.04
*Aramayo Mines, s, t, b, c	Bolivia	840,000	25 Sw.fr.	5.25 Sw.fr.	4,410,000	3.25	3,150,000	.....	Dec., 1925	1.25
*Asbestos Corporation	Quebec	30,000	$100	.....	.....	$5.50	165,000	1,200,000	Oct., 1925	1.50
*Asbestos Corporation, pfd	Quebec	40,000	100	$6.00	$240,000	6.00	240,000	2,390,000	Oct., 1925	1.50
*Belmont Surf Inlet	B. C.	2,500,000	1	.....	.....	.025	62,500	750,000	.....	.025
*British Platinum & Gold	Colombia	596,614	£1	1s.	£29,831	6d.	£14,915	.....	Feb., 1925	6d.
Castle Trethewey, pfd., s	Ont.	200,000	$1	$0.055	$11,027	$0.035	$7,000	$18,000	Apr., 1925	$0.035

Mining Dividends in 1924 and 1925—Concluded

Company Name	Situation	Shares Issued	Par Value	1924 Per Share	1924 Total	1925 Per Share	1925 Total	Total Paid to End of 1925	Latest Dividend Paid Date	Per Share
Foreign—concluded										
Cerro de Pasco Copper, c, s, g...	Peru	1,122,842	No	$4.00	$4,413,608	$5.00	5,614,060	.....	Dec., 1925	1.00
Chile Copper	Chile	4,391,245	$25	2.50	10,977,650	2.50	10,977,987	$32,864,437	Dec., 1925	.625
*Coniagas Mines, s	Ont.	800,000	5	.125	100,000	.....	.....	11,340,000	May, 1924	.125
*Consol. Mining & Smg., c, l, z...	B. C.	427,718	25	1.50	641,577	1.50	641,577	8,687,662	July, 1925	.75
*Dome Mines, g	Ont.	1,000,000	No	2.00	2,000,000	2.00	2,000,000	8,925,420	Oct. 1925	.50
El Oro Mining & Ry., g, s	Mex.	1,147,500	£1	6d.	£28,687	.....	.....	£2,185,250	Nov. 1924	6d.
Erupcion Mining, l, s	Mex.	1,250,000	$1	$0.575	$718,750	$0.70	$875,000	$1,906,250	Oct. 1925	$0.15
*Frontino & Bolivia Gold	Colombia	140,000	£1	2s.	£14,000	9d.	£6,300	.....	Aug. 1925	9d.
*Frontino & Bolivia, pfd	Colombia	23,390	£1	2s.	2,339	2s.	2,339	.....	.....	.....
Great National Mex. Smg. c	Mex.	10,000	$100	.....	.....	107.50	1,075,000	.....	.....	.....
Hollinger Consol. Gold	Ont.	4,920,000	5	$0.65	3,198,000	.89	4,378,800	30,530,800	Dec. 1925	$0.08
*Howe Sound	B. C.	1,984,150	1	.10	198,415	.10	198,415	1,785,735	Oct. 1925	.10
International Nickel, n. c	Ont.	1,673,384	25	....	.....	1.00	1,673,384	54,787,060	Dec. 1925	.50
International Nickel, pfd	Ont.	89,126	100	6.00	534,756	6.00	534,756	10,695,006	Nov. 1925	1.50
Keeley Silver Mines, s, co	Ont.	2,000,000	1	.24	480,000	.24	480,000	1,280,000	Sept. 1925	.12
Kerr Lake, s	Ont.	600,000	4	.25	150,000	.25	150,000	9,585,000	Oct. 1925	.125
Lake Shore Mines, g	Ont.	2,000 000	1	.19	380,000	.30	600,000	1,620,000	Dec. 1925	.10
Lorrain Trout Lake, s	Ont.	1,500,000	1	.....	.....	.10	150,000	150,000	July 1925	.05
Lucky Tiger-Combination, g, s	Mex.	715,337	10	1.17	836,944	1.11	794,024	11,361,006	Dec. 1925	.16
McIntyre Porcupine, g	Ont.	798,000	5	1.00	774,125	1.00	798,000	5,207,408	Dec. 1925	.25
*Mexico Mines of El Oro, g, s	Mex.	210,000	£1	11s.	£115,500	4s. 6d.	£47,250	.....	Dec. 1925	2s. 6d.
Mining Corp. of Canada, s	Ont.	1,660,050	$5	.....	.....	$0.125	$207,506	$5,706,381	July 1925	$0.125
*Mond Nickel, n. c	Ont.	900,000	£1	2s. 6d.	£112,500	1s. 6d.	£60,000	.....	Aug. 1925	1s. 6d.
*Mond Nickel, 7% cum. pfd	Ont.	500,000	1	1s. 8d.	35,000	1s. 8d.	35,000	.....	Aug. 1925	.....
*Mond Nickel, 7% non-cum. pfd	Ont.	2,000,000	1	1s. 8d.	140,000	1s. 8d.	140,000	.....	Aug. 1925	.....
N. Y. & Honduras Rosario, s, g	Honduras	200,000	$10	$1.75	350,000	$1.75	350,000	$6,950,000	Oct. 1925	.50
Nipissing Mines, s	Ont.	1,200,000	5	.90	$1,080,000	.75	$900,000	27,420,000	Oct. 1925	.15
Ouro Preto Gold	Brazil	39,429	£1	2s. 6d.	£4,928	6d.	£985	£124,604	 1924	6d.
Ouro Preto Gold, pfd	Brazil	42,656	1	6d.	1,066	.....	.....		 1924	2s. 6d.
*Patino Mines, t	Bolivia, Chile	1,380,316	£1	.....	.....	5s.	£345,079	.....	March 1925	5s.
Pato Mines, g	Colombia	100,000	£1	.....	27,125	.....	.....	£369,250	1924	.....
Premier Gold, g, s	B. C.	5,000,000	$1	$0.32	$1,600,000	$0.34	$1,700,000	$7,750,000	Oct. 1925	$0.08
St. John del Rey, g	Brazil	546,265	£1	2s.	£54,626	.....	.....	£3,057,245	Dec. 1924	9d.
St. John del Rey, pfd	Brazil	100,000	£1	2s.	£10,000	.....	.....		Dec. 1924	1s.
*San Francisco Mines, l, z, s, g	Mex.	1,503,959	10s.	1s. 3d.	93,997	3s. 6d.	£263,192	£469,880	July 1925	1s. 6d.
Silversmith Mines, s, l, z	B. C.	2,500,000	.20	$0.07	$175,000	$0.05	$125,000	$525,000	Oct. 1925	$0.01
Wright-Hargreaves, g, s	Ont.	2,750,000	$1	.20	550,000	.20	550,000	1,650,000	Oct. 1925	.05

*From published reports; request for official data unanswered. c, copper; g, gold; l, lead; s, silver; m, manganese; z, zinc; a, arsenic; t, tin; b, bismuth; co, cobalt.

Important Mining Stocks in 1925

Company	Exch.	High		Low		Last	Net Change	Sales
COPPER								
Anaconda	N. Y.	53¼	No. 6	35½	Ap. 21	50⅛	+2⅜	1,956,800
Arcadian Con.	B.	3	Ja. 3	*50	De. 18	*62	—2	32,022
Ariz. Com'l	B.	15⅜	Fe. 6	9½	Ma. 28	12½	—1⅞	112,423
Calaveras	N. Y.C.	4⅜	No.	1⅛	Ja.	3⅞	+1⅞	20,060
Cal. & Ariz.	B.	61	De. 29	45	Ap. 22	60½	+3⅞	15,844
Cal. & Hecla	B.	18⅞	Ja. 2	12½	My. 26	14⅝	—4⅜	188,144
Canario	N.Y. C.	8½	Oc.	3 5/16	Ma.	5	+⅞	527,400
Cerro de Pasco	N. Y.	64⅜	No. 14	43¼	Mh 24	62⅜	+7½	841,200
Chile Copper	N. Y.	37½	Ja. 2	30½	Mh.30	35⅜	—1⅝	952,550
Chino	N. Y.	28¾	Fe. 9	19	Ap. 23	19½	—8⅛	41,900
Con. Cop. M	N.Y. C.	4	Fe.	1⅞	Au.	2	—1½	170,900
Copper Range	B.	33	Ja. 10	18	De. 22	18⅛	—12⅝	99,551
Crystal Cop	B. C.	*72	Ja.	*29	Oc.	*56	+4	.....
Davis-Daly	B.	*78	Fe. 6	*1	De. 27	*1	—64	32,317
East Butte	B.	6½	Ja. 2	3	Je. 5	3½	—2¼	53,338
First National	N.Y.C.	*40	Ja.	*10	Oc.	*10	—24	17.000
Franklin	B.	1⅜	Ja. 24	*40	Ja. 7	*55	—40	10,276
Gadsden	B. C.	*85	Ja.	*30	Je.	*35	—29	.....
Granby Con	N. Y.	21⅞	De. 7	13	Mh.30	20½	0	183,100
Greene-Can	N. Y.	19½	Ja. 2	11⅞	Mh.19	12⅜	—6⅝	57,600
Hancock	B.	1⅜	Fe. 6	*50	Je. 13	*80	—45	3,648
Howe Sd. (new)	N. Y.	31¼	No. 4	16½	Je. 11	27⅞	.....	202,200
Inspiration	N. Y.	32¼	Ja. 12	22¼	Ap. 22	25	—7	265,500
Iron Cap	B. C.	4¼	Ja.	1⅜	Jy.	2⅛	—⅛	.....
Isle Royale	B.	20½	Ja. 7	9⅞	Ap. 22	11⅛	—7⅛	33,326
Jerome Verde	N.Y. C.	2	Ap.	*50	Se.	*84	—14	196,300
Kennecott	N. Y.	59½	No. 6	46½	Mh.30	55	— ⅜	2,581,800
Keweenaw	B.	1½	Ja. 19	*50	Je. 29	*50	—75	9,278
Lake Copper	B.	3	Ja. 2	1	Ap. 11	1	—2	12,930
Magma Cop	N. Y.	46	No. 6	34	Mh.31	43	+½	409,800
Mason Valley	N.Y. C.	2⅜	Ja.	1⅛	De.	2	—⅜	67,700
Mass. Con	B.	1½	Ja. 2	*40	My.14	*50	—1⅛	9,610
Miami Cop	N. Y.	24⅜	Ja. 13	8	My.12	12⅜	—10⅜	561,800
Mohawk	B.	41	Ja. 13	25½	Je. 9	32¼	—6½	36,800
Mother Lode	N. Y.	9½	Ja. 2	6	My. 4	7⅜	—1⅛	533,600
Nevada Con	N. Y.	16⅜	Ja. 7	11⅞	Ap. 27	13	—3	266,600
New Cornelia	B.	25	Ja. 2	18	Mh.30	19½	—5½	45,068
North Butte	B.	3⅞	No. 16	*90	My. 5	2⅜	—½	122,845
Ohio Copper	N.Y. C.	1½	Ja.	*67	De.	*67	—83	497,600
Old Dominion	B.	27	Ja. 10	16⅜	De. 30	17	—8½	29,710
Phelps Dodge	O. M.	139	Oc.	98	My.	124	+15½	.....
Quincy	B.	38	Ja. 10	19	Ap. 22	21½	—9⅝	35,895
Ray Consol	N. Y.	17⅜	Fe. 9	11⅜	Ap. 22	12⅜	—4⅜	1,023,900
Ray Hercules	N.Y. C.	*16	Ja.	*8	Fe.	*8	—7	21,000
St. Mary's M.L.	B.	48	Ja. 12	28½	Ap. 21	35½	—10¼	39,913
Seneca Cop. (old)	N. Y.	1⅝	Ja. 5	⅜	Fe. 20	¾	—⅝	99,000
Seneca Cop. (new)	N. Y.	11	No. 12	9	No. 18	9½	.....	72,400
Shannon	B.	1½	Ja. 9	*50	My. 1	*55	—70	32,898
Shattuck-Ariz	N. Y.	7⅞	Ja. 3	5½	Ap. 22	6½	—1½	30,900
Sup. & Boston	B.	2	Ja. 5	*70	My.13	*75	—1⅜	22,515
Tenn. C. & C	N. Y.	16	De. 7	7⅜	Ap. 1	14½	+5½	846,200
United Verde X.	N.Y. C.	29¾	Ja.	20½	Ap.	28	—2	69,800
Utah Copper	N. Y.	111	No. 18	82	Mh.19	98	+10½	48,350
Utah M.&T	B.	1	Se. 18	*40	Jy. 7	*65	+15	172,043
Victoria	B.	1¼	Ja. 31	*14	Au. 7	*35	—55	11,155
Walker	S. L.	3.65	Ja. 1.475		De.	1⅛	—1⅞	156,426
NICKEL-COPPER								
Inter. Nickel	N. Y.	48⅜	No. 20	24½	Mh.18	45	+18½	3,378,520
Int. Nick. pfd	N. Y.	102	No. 19	94	Ja. 6	102	+8⅛	9,205

Company	Exch.	High		Low		Last	Net Change	Sales
LEAD								
Carnegie L.&Z	P.	8¼	Mh. 4	Ja.		6¾	+2⅜	127,889
Gladstone M	S.	*34½	De. *10	Ja.		*34	.....	332,584
National Lead	N. Y.	174⅝	No. 7	138½	Ap. 27	168	+6⅞	229,000
Nat. Lead pfd	N. Y.	119¼	Se. 18	114½	Se. 2	116	—½	11,200
St. Joseph Lead	N. Y.	52½	My.25	35¾	Jy. 1	45⅞	+⅛	472,710
ZINC								
Am. Z.L.&S	N. Y.	12½	Ja. 9	7	My.12	8⅛	—3⅛	97,300
A.Z.L.& S. pfd	N. Y.	44⅝	De. 4	24⅞	My. 1	37½	+2½	129,500
Butte C.&Z	N. Y.	8⅞	Ja. 2	4½	Mh.31	5⅝	—2⅛	194,600
Butte & Sup	N. Y.	24½	Ja. 19	6½	My. 5	14⅜	—8⅞	435,500
Callahan Z.L	N. Y.	4⅜	Fe. 19	1⅛	Oc. 10	2	—2½	219,100
Eagle Picher	C.	40⅛	Ja. 31	Mh.		34	.....	.....
Eagle P. pfd	C.	112	Jy. 108	Fe.		110	.....	.....
N. J. Zinc	N.Y. C.	214½	No. 181	My.		210	+15½	29,260
United Zinc	N.Y. C.	*75	De. *20	Oc.		*70	+55	12,600
Yellow Pine	L. A.	*75	Ja. 15	*30	Oc. 29	*40	—35	.....
GOLD								
Alaska Gold	N. Y.	*37½	Ja. 14	*15	Ja. 2	*25	+10	15,000
Alaska Jun	N. Y.	2½	Oc. 26	1	Ja. 6	1⅞	+⅜	152,530
Argonaut	T.	*48	Fe.	*10½	No.	*16	—18	.....
Barry-Hol	T.	*50	Ap.	*18	Se.	*25¼	.....	.....
Carson Hill	B.	*80	Au. 25	*10	Au. 4	*41	—18	43,469
Con.W.Dome L.	T.	*25	De.	*10½	Oc.	*23½	+6½	.....
Cresson Con	N.Y. C.	4	Fe.	2⅛	De.	2⅜	—⅜	75,700
Crown Res	T.	*55	Ja.	*15	Au.	*23	—27	.....
Dome	N. Y.	18⅛	No. 20	12⅜	Ap. 14	17	+3⅞	209,400
Golden Cycle	C. S.	1.65	No. 28	1.40	Ja. 24	1.58	+0.20	97,500
Hollinger	T.	17.50	De.	13.30	Mh.	17.50	+2	.....
Homestake	N. Y.	50	Jn. 12	43	Ja. 2	48	+5	29,400
Jib Consol	N.Y. C.	*61	Ja.	*6	Ap.	*7	—48	1,726,500
Kirkland Lake	T.	*92½	No.	*33	Oc.	*85	+55	.....
Lake Shore	T.	10	No.	4.51	Ja.	9.60	+4.10	.....
McIntyre-P	N. Y.	22⅞	Oc. 28	16	Ja. 2	22½	+6⅜	77,775
Newray	T.	*44	De.	*17	My.	*43	+19	.....
Night Hawk P	T.	*49½	Fe.	*6	De.	*10	—18	.....
Noranda (new)	T.	15½	De.	9.10	No.	15½	.....	.....
Portland	C. S.	*66	De. 12	*30	Jy. 3	*61	+21	144,450
Rand Mines	N. Y.	39½	Au. 5	33⅓	No. 23	33⅞	+¾	5,100
Teck-Hughes	T.	3	De.	1.23	Ja.	2.63	+1.38	.....
Tom Reed	L. A.	*73	Mh. 4	*30	Jy. 23	*55	+15	.....
Tough-Oakes	T.	*61	Oc.	*20	My.	*55	+14½	.....
United East'n	N.Y. C.	*63	Fe.	*39	Ja.	*39	+4	141,200
Vipond Con	T.	1.61	De.	1.01	My.	1.61	+26	.....
Wright-Harg	T.	7.95	De.	4.15	Ja.	7.85	+3.85	.....
GOLD AND SILVER								
Carnegie Met	P.	20	No.	14	Au.	18⅝	.....	21,290
Con. Cortez	N.Y. C.	*25	Fe.	*5	De.	*6	—4	149,000
Con. Virginia	S. F.	*50	Dec.	*3	Ju.	*30	+20½	.....
Continental	N.Y. C.	1½	Ap.	*45	De.	*45	—80	5,500
Dolores Esp	N.Y. C.	1⅞	No.	*35	Ja.	*82	+56	67,400
Premier Gold	N.Y. C.	2⅞	Se.	2	Ja.	2½	0	231,150
Tonopah Bel	N.Y. C.	2½	De.	*52	Ap.	2½	+1.92	87,780
Tonopah Div	N.Y. C.	*39	Ja.	*21	Ja.	*23	+3	34,000
Tonopah Ext	N.Y. C.	3 3/16	Fe.	1	Au.	1½	—1 1/16	262,300
Tonopah Mng	N.Y. C.	6	Au.	1 7/16	Mh.	4¾	+2⅝	163,300
Unity Gold	N.Y. C.	*95	Ju.	*20	De.	*20	—37	45,100
West End Con	N.Y. C.	*56	Jy.	*24	Ap.	*25	—21	29,000
Yukon Gold	N.Y. C.	*74	Oc.	*26	Au.	*51	+1	30,200

SILVER

Alvarado	N.Y. C.	2⅜	Mh.	*50	My.	*98	−52	8,100
Beaver Con	T.	*57	No.	*25	Ju.	*51	+24½	.....
Castle-Treth.	T.	1.60	De.	*71	Ja.	1.50	+77	.....
Coniagas	T.	5	No.	1⅛	Ap.	4.60	+2.40	.....
Keeley	T.	2.32	Fe.	1.40	Oc.	1.67	−50	.....
Kerr Lake	N.Y. C.	1⅛	Fe.	*88	My.	1	−⅜	77,100
La Rose	T.	*53	My.	*7½	Ja.	*39	+33	.....
Lorrain T. L.	T.	1.34	Ja.	*85	No.	1.10	−21	.....
McKinley D. S.	T.	*42½	Mh.	*14½	Oc.	*25	+8	.....
Mining Corp.	T.	3.40	De.	2.35	Jy.	3.31	+31	.....
Nipissing	N.Y. C.	6¾	Ja.	4½	My.	6¾	+½	169,600
Temiskaming	T.	*30	Mh.	*11½	No.	*14	−6	.....

SILVER-LEAD

Ahumada	N. Y.	12½	My. 27	7¼	Oc. 13	9	−¼	201,550
Alta Merger	S. L.	*4	.....	*1	.....	*3	.....	116,709
Bingham	B.	60½	Oc. 24	28½	Jy. 1	53½	+22	228,389
Cardiff	S. L.	1.70	Fe.	*49	Oc.	*55	−60	54,377
Chief Con	S. L.	4	Fe.	2.40	Au.	3¾	+½	33,754
Emma	S. L.	*4½	.....	*¼	.....	*1	.....	1,281,997
Erupcion	B. C.	3¾	Fe.	1⅛	De.	2¾	+¾	.....
Federal M. & S.	N. Y.	95½	De. 31	15½	Mh. 13	95½	+71½	68,700
Fed. M.&S. pfd.	N. Y.	99¾	De. 28	49½	Mh. 11	99½	+37¾	246,100
Florence Silver	S.	*9	Ja.	*1	My.	*1¼	−5¾	.....
Hecla Mining	N.Y. C.	18⅛	No.	12½	Ap.	18	+5½	157,300
Iron Blossom	S. L.	*37	Ap.	*26½	Ja.	*37	+11	.....
Iron King	S. L.	*93	.....	*34	.....	*36	.....	162,812
Keystone	S. L.	*84	.....	*58	.....	*63	.....	223,313
Lucky Jim	S.	*18½	.....	*7½	.....	*12½	.....	255,400
Mammoth	S. L.	3.10	.....	¼	.....	2.80	.....	158,791
Marsh Mines	S.	*10½	Oc.	*4	Mh.	*7½	+1½	189,970
Park City	B.	6½	Au. 23	4	My. 19	5½	+1	8,166
Park Utah C.	S. L.	8½	No.	3½	Ap.	7.80	.....	399,781
Prince Con	S. L.	*52	Jy.	*1	No.	*9	−10	644,217
Silver King Coa.	S. L.	10½	De.	5.30	Fe.	9.55	+3.60	59,997
Silversmith	S.	*39½	De.	*17	Jy.	*39	+11½	140,048
Tamarack-Cus.	S.	1	Ja.	*35	De.	*35	−62	8,950
Tintic Std	S. L.	15	Oc.	8.40	Ap.	13½	+5	78,489
Utah-Apex	B.	8⅞	Ja. 23	3¾	Ja. 2	7⅞	+3⅝	761,378
Western Utah	N.Y. C.	*25	Fe.	*10	Mh.	*10	−5	127,000

IRON

Bethlehem St.	N. Y.	*53½	Ja. 13	37	Je. 5	48½	−2½	1,434,400
Charcoal Iron	D.	*40	Mh.	*10	Ja.	*20	+5	.....
Charcoal I. pfd.	D.	*97	Ap.	*72	Ja.	*85	+16	.....
Colo. F. & Iron	N. Y.	48½	Ja. 13	32½	Ap. 21	36½	−6½	995,300
Colo. F. & I. pfd.	N. Y.	110½	Au. 5	106	Se. 22	106	+3½	400
Gt. Nor. Iron O.	N. Y.	40¾	Ja. 19	25	De. 5	26½	−9½	943,140
Inland Steel	N. Y.	50	Fe. 2	38¾	My. 1	43	−4	203,100
Mesabi Iron	N.Y. C.	4⅜	Ja.	1⅜	De.	1½	−2	71,640
Replogle Steel	N. Y.	23½	Ja. 13	12½	Je. 12	15½	−5½	588,800
Republic I. & S.	N. Y.	64⅜	Ja. 3	42½	Ap. 30	59½	−2⅜	614,200
Rep. I.&S. pfd.	N. Y.	95	Ja. 13	84½	Jy. 7	94	+½	22,900
Sloss-Sheffield	N. Y.	143½	De. 8	80½	Mh. 30	135¼	+53¼	444,420
Sloss-Shef. pfd.	N. Y.	105½	Jy. 28	92	Ju. 5	103	+8	9,500
U. S. Steel	N. Y.	139½	No. 7	112½	Mh. 30	135⅞	+16½	10,302,090
U. S. Steel pfd.	N. Y.	138	No. 6	122¼	My. 7	126	+2⅜	149,995
Va. Iron C.&C.	N. Y.	46	De. 7	30	Je. 30	43	+1½	3,600
Va. I. C.&C.pfd.	N. Y.	79½	Ja. 12	70	Se. 21	77	−2	800

VANADIUM

Vanadium C.	N. Y.	34¼	Jy. 9	25⅜	My. 4	31⅛	+1⅛	269,500

ASBESTOS

Asbestos Corp.	M.	98	No. 17	38	Ja. 6	91	+56	124,730
Asbestos pfd.	M.	117	Je. 30	74	Ja. 5	111	+37	107,294

SULPHUR

Freeport Texas	N. Y.	24⅛	Oc. 13	18	Mh. 18	20⅛	+9½	1,949,400
Texas Gulf	N. Y.	121⅛	De. 31	97½	Fe. 17	121	+13	1,953,100

DIAMONDS

De Beers Con.	N. Y.	29	De. 29	20⅛	Mh. 18	29	+6⅛	9,200

PLATINUM

So. Am. G.&P.	N.Y. C.	6¼	No.	2½	My.	4½	+1	230,900

MINING, SMELTING, REFINING AND GENERAL

Amer. Metal	N. Y.	57⅛	Oc. 26	45½	Mh. 30	54¼	+1½	356,800
Am. Metal pfd.	N. Y.	119	No. 9	111	Mh. 30	116	+½	6,900
Amer. S. & Ref.	N. Y.	144½	De. 31	90⅜	Mh. 30	144½	+45¾	460,930
A. S. & R. pfd.	N. Y.	115⅛	Oc. 9	105½	Ja. 5	13⅜	+7½	42,750
Consol M. & S.	N. Y. C.	181½	De.	48	Ja.	181	+131½	4,910
Federated Met.	P.	41⅜	Fe.	22½	De.	22½	−14½	5,898
Newmont	N. Y. C.	47½	De.	43¼	Oc.	47	.....	78,200
Southwest M.	N. Y. C.	2½	No.	¾	Mh.	2½		1,500
U. S. S.R.&M.	N. Y.	51	De. 29	30	Fe. 17	49⅞	+11⅛	274,700
U.S.S.R.&M.pfd.	N. Y.	49½	De. 23	44	Ap. 16	49½	+3	29,600

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Mining and Metallurgical Society of America, 2 Rector St., New York.
Society of Economic Geologists, 42 Broadway, New York.
Geological Society of America, Museum of Natural History, Columbus Ave. and 77th St., New York.
Geological Society of Washington, U. S. Geological Survey, Washington, D. C.
American Electrochemical Society, Columbia University, New York.
American Chemical Society, 1709 G St., N. W., Washington, D. C.
Institution of Mining and Metallurgy, 225 City Road, London E. C. 1, England.
Society of Chemical Industry, Central House, Finsbury Square, London, E. C. 2, England; Pratt Institute, Brooklyn, New York.
Geological Society of London, Burlington House, London W., England.
Canadian Institute of Mining and Metallurgy, Drummond Building, Montreal, Quebec, Canada.
Australasian Institute of Mining and Metallurgy, 48 Queen St., Melbourne, Victoria, Australia.
Chemical, Metallurgical and Mining Society of South Africa, 100 Fox St., Johannesburg, Transvaal, South Africa.

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Ontario, Canada—Alfred G. Burrows, Provincial Geologist, Toronto, Ont., Canada.

Trade Associations

General—American Bureau of Metal Statistics, 115 Broadway, New York; American Mining Congress, 841 Munsey Building, Washington, D. C.; Association of Arizona Mining Men, Phoenix, Ariz.; California Metal and Mineral Producers' Association, San Francisco; Chamber of Commerce and Mines, Douglas, Ariz.; Chamber of Mines and Oil, Los Angeles, Calif.; Idaho Mining Association, Mackay, Idaho; Montana Mining Men's Association, Helena, Mont.; National Metal Trades Association, Chicago, Ill.; Nevada Mine Operators' Association, Reno, Nev.; Northwest Mining Association, Spokane, Wash.
Copper—Copper and Brass Research Association, 25 Broadway, New York; Copper Export Association, 25 Broadway, New York.
Gold—American Gold and Silver Institute, H. N. Lawrie, Managing Director; Munsey Building, Washington, D. C.
Graphite—Plumbago-Graphite Association, 17 State St., New York.
Gypsum—The Gypsum Industries, 844 Rush St., Chicago.
Iron and Steel—American Iron and Steel Institute, 40 Rector St., New York; American Pig Iron Association, Penton Building, Cleveland, Ohio; Association of American Steel Manufacturers, Pittsburgh, Pa.; Lake Superior Iron Ore Association, Cleveland, Ohio.
Limestone, Lime—Indiana Limestone Quarrymen's Association; National Agricultural Limestone Association, Columbus, Ohio; National Lime Association, 918 G Street N.W., Washington, D. C.
Petroleum—American Petroleum Institute, 250 Park Ave., New York.
Phosphate Rock—Phosphate Export Association, 301 Produce Exchange Building, New York.
Portland Cement—Portland Cement Association, 347 Madison Ave., New York.
Refractories—American Refractories Institute, 2202 Oliver Building, Pittsburgh, Pa.
Sand and Gravel—National Sand and Gravel Association, Suite 903, Munsey Building, Washington, D. C.
Slate—National Slate Association, W. S. Hays, Secretary; 791 Drexel Building, Philadelphia, Pa.
Zinc—American Zinc Institute, 27 Cedar St., New York.

The Market Report

Moderate Buying of Metals at Steady Prices

Copper Quotations Stiffen—Zinc Slightly Easier—Lead Strong, With Good Business

New York, Jan. 13, 1926—Lead has been the most active of the non-ferrous metal markets during the week ending today, though business in copper and zinc cannot be called dull. Prices have shown little change, though copper is fractionally higher and zinc somewhat easier. Tin continues quiet. Antimony and silver are both slightly lower in quiet markets.

Copper Sellers Firm at 14.125c.

Though tempted by offers from prominent buyers to take large tonnages at concessions from 14.125c., delivered, copper sellers apparently are holding firm at that price for deliveries at normal freight-rate points. Good-sized tonnages have brought 14.25c. delivered in the Middle West and, on the other hand, some sales were made at 14.00 and 14.05c. last Thursday. Producers believe that many large purchases of February metal are yet to be made and are waiting for buyers to meet their price. A feature is the apparent improvement in the London market. During the last few days several thousand tons have brought 14.30c. and 14.325c., c.i.f. Dealers who have been selling at considerably lower levels appear to have disposed of their supplies. Quotations in London in the last two days have reflected this improvement.

Lead Demand Good

Demand for lead has been better in the week ended today, most of the selling agencies doing a substantial business, mostly for February shipment, at practically the same prices as those of last week. January lead is scarce, and premiums are generally quoted for immediate shipment, but consumers seem well supplied for their current requirements, and the tonnage sold at the premium prices is insignificant. The American Smelting & Refining Co. continues its contract price of 9.25c., New York, and has sold freely at that level except for January shipment. Western producers selling in the East have obtained as high as 9.35c.

The St. Louis market has been fairly active, most of the business having been done at 9.10c., a slight recession from the prices asked by one of the producers last week. Desilverized has sold for 9½@9.15c., and corroding grades in the Chicago market have brought 9.30c.

The London market shows signs of strengthening, but prices there would have to advance about £2 to make it advisable to export all lead smelted here from foreign ores. So, unless present supplies prove entirely inadequate for foreign consumers, lead prices in the domestic market would seem to be fairly well stabilized at the present levels for the time being. The consensus of opinion seems to be that the lead market is likely to continue strong well into the spring.

Zinc Slightly Lower

The figures of the American Zinc Institute, showing an increase in stocks of 2,773 tons during December, seem to have eased buyers' minds somewhat, and the current price reflects this feeling. Some buying by dealers who were short of January zinc has been done at 8.75c. for prompt shipment, but the volume of this business has been small. The February price is 8.50c. Statistics follow:

	Dec. 1925	Year 1925
Stock, first day....	6,922	21,208
Produced	53,794	590,928
	60,716	612,136
Stock, Dec. 31.....	9,295	9,295
Shipped from plant for export	1,532	65,143
Retorts operating Dec. 31	95,029	

Daily Prices of Metals

Jan.	Copper N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L
7	13.85	61.875	62.75	9.25	9.10	8.55
8	13.875	61.75	62.625	9.25	9.10	8.55
9	13.875	61.625	62.50	9.25	9.10	8.50
11	13.90	61.375	62.25	9.275	9.10	8.50
12	13.875	61.875	62.75	9.275	9.10	8.50
13	13.90	62.125	63.00	9.25	9.10	8.50
Av.	13.879	61.771	62.646	9.258	9.10	8.517

*The prices correspond to the following quotations for copper delivered: Jan. 7th, 14.10c.; 8th and 9th, 14.125c.; 11th, 14.15c.; 12th, 14.125c.; 13th, 14.15c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

Jan.	Copper			Tin		Lead		Zinc	
	Standard		Electro-lytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
7	59½	60¼	65½	285¼	278¼	34⅞	34 13/16	38 13/16	37 15/16
8	59⅝	60½	65½	285¼	278¼	34 15/16	34⅞	39 3/16	38¼
11	59½	60½	65½	283¼	277¼	35	34 15/16	38 15/16	38 1/16
12	59⅝	60¾	66	285½	278¼	35⅜	35 3/16	38 1/16	37 13/16
13	59½	60⅝	66	287	278⅞	35 5/16	35 1/16	38¾	37⅞

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

Jan.	Sterling Exchange "Checks"	Silver		Gold London	Jan.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
7	4.84½	68⅝	31 13/16	84s10½d	11	4.84¾	68⅝	31⅝	84s11d
8	4.84⅝	68½	31 13/16	84s10½d	12	4.85	68⅝	31⅝	84s10½d
9	4.84⅝	68½	31 13/16	....	13	4.85⅛	68⅜	31 9/16	84s10½d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

Tin Slightly Easier

Tin prices are down slightly from last week, a fact which stimulated a little business, particularly on Thursday, when the good demand made the market exceedingly strong at the close. The market for spot tin has varied between 62 and 63c. all week, closing at about the higher figure today. March tin sold for about half a cent less than spot.

Sterling Stronger

Sterling was higher than for some months yesterday, but francs were weak. Closing cable quotations on Tuesday, Jan. 12, were: francs, 3.755c.; lire, 4.04⅛c.; and marks, 23.81c. Canadian dollars, ⅞ per cent discount.

Silver Quiet but Steady

The tendency of silver during the past has been slightly downward, and the markets of the world have been rather quiet. China has resumed selling to some extent; India has been only a moderate buyer. The market remains steady.

Mexican Dollars: Jan. 7th, 52⅝c.; 8th, 9th, 11th, 12th and 13th, 52½c.

Some of the Mexican dollar figures were omitted last week. The correct prices are as follows: Dec. 31st, 52½c., Jan. 1st, Holiday; 2d and 4th, 52⅝c., 5th and 6th, 52½c.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28c. per lb.; 98 per cent, 27c. London, 98 per cent, £118 per long ton.

Antimony — Per pound, f.o.b. New York: Chinese brands, spot, 25@24½c. February arrival, 24½@24c. Cookson's "C" grade, spot, 24½c. Sellers contend that current "high" prices are justified by small offerings from China.

Bismuth—$3.30@$3.35 per lb., in ton lots. London, 12s. 6d.

Cadmium—60c. per lb. London, 1s. 9d. for Australian metal.

Iridium — $360 @ $375 per oz. for 98@99 per cent. Nominal. London £80@£85 for 99.5 per cent.

Nickel—Ingot, 35c.; shot, 36c.; electrolytic, 39c. (99.75 per cent); London, £170@£175 per long ton.

Platinum—$120 per oz. refined officially quoted. Sales also at $115@$118. Crude, $114@$114.50. London, £23 10s. @£25 for refined; crude £21@£22½.

Quicksilver—Per 75-lb. flask: $87½@ $88½ for spot and forward. San Francisco $90. London, £15@£15½.

The prices of Cobalt, Germanium Oxide, Lithium, Magnesium, Molybdenum, Monel Metal, Osmium, Palladium, Radium, Rhodium, Ruthenium, Selenium, Tellurium, Thallium, Tungsten, and **Zirconium** are unchanged from the issue of Jan. 9.

Metallic Ores

Manganese Ore—Per long ton unit of Mn, c.i.f. North Atlantic ports: Caucasian, Brazilian, Cuban, and Chilean, 40@43c.; nominal.

Tungsten Ore—Per unit of WO_3, N.Y.: **Wolframite, $11.50@$12.50; Western** scheelite, $12.50@$13. Domestic demand very light, market supported by good European demand.

Chrome Ore, Galena and **Pyrite Radio Crystals, Iron Ore, Molybdenum, Tantalum,** and **Vanadium Ores** are unchanged from quotations in the Jan. 9 issue.

Zinc Blende and Lead Ore Prices Reported Unchanged

Joplin, Mo., Jan. 9, 1926

Zinc Blende	Per Ton
High	$61.20
Premium, basis 60 per cent zinc	$57.00@$58.00
Prime Western, basis 60 per cent zinc	$56.00
Fines and slimes, 60 per cent zinc	$54.00@$52.00
Average settling price, all grades	$56.42
Lead Ore	
High	$121.75
Basis 80 per cent lead	$115.00
Average settling price, all grades	$118.00

Shipments for the week: Blende, 9,853; lead, 911. Value, all ores the week, $663,530.

The higher average settling prices of zinc and lead are said to be occasioned by shipment of higher-grade ores this week, with but a light tonnage of fines and slimes included. An unconfirmed rumor to the effect that one buyer, in omitting dockage on impurities, has virtually advanced prices, has become current.

Shipments this week were neglible, owing to very light purchases last week, and the production is still below normal, only slightly exceeding 16,000 tons of blende.

Lead shipments of less than one thousand tons are less than any week since Oct. 17, 1925. Producers were selling on $145 basis a year ago and are loath to accept the present offering.

Platteville, Wis., Jan. 9, 1926

Zinc Blende	Per Ton
Blende, basis 60 per cent zinc	$58.50
Lead Ore	
Lead, basis 80 per cent lead	$120.00

Shipments for the week: Blende, 911 tons; lead, none. Shipments for the year: Blende, 911; lead, none. Shipments for the week to separating plants, 1,807 tons blende.

Non-Metallic Minerals

Amblygonite, Andalusite, Asbestos, Barytes, Bauxite, Borax, Celestite, Chalk, China Clay, Diatomaceous Earth, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Greensand, Gypsum, Ilmenite, Iron Oxide, Lepidolite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Potash, Pumice, Pyrites, Quartz Rock Crystals, Rutile, Silica, Spodumene, Sulphur, Talc, Tripoli, and Zircon are unchanged from prices in the Jan. 9 issue.

Mineral Products

Arsenious Oxide (White arsenic)—3c. per lb. London, £14½@£15 per long ton.

Sodium Nitrate—Spot, crude, $2.67 per 100 lb., ex vessel, Atlantic ports.

Copper Sulphate, Sodium Sulphate, and **Zinc Oxide** are unchanged from prices in the Jan. 9 issue.

Ferro-Alloys

Ferrocerium, Ferrochrome, Ferromanganese, Ferrophosphorus, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium are** unchanged from prices in the Jan. 9 issue.

Metal Products

Rolled Copper—Sheets, 22½c.; wire, base price, 16c. per lb.

Lead Sheets—Full, 13c. per lb.; cut, 13¼c.

Nickel Silver—29⅜c. per lb. for 18 per cent nickel Grade A sheets.

Yellow (Muntz) Metal — Dimension sheets, 20½c. per lb.; rods, 17½c.

Zinc Sheets—12c. per lb., f.o.b. works.

Refractories

Chrome Brick, Firebrick, Magnesite Brick, Silica Brick, and **Zirkite are unchanged** from prices in the Jan. 9 issue.

Steel Firm—Pig Iron Dull —Coke Advances

Pittsburgh, Jan. 12, 1926

The steel market is still decidedly dull, both as to new buying and specifying on contracts. The condition is attributed to inventory and other year-end adjustments, and increased activity is expected after the middle of the month. General market conditions are regarded as perfectly sound.

Mills in most cases were well fortified with specifications to run them practically through January. Operations in the last week have been fully up to the average in November and December.

According to the preliminary statement, steel ingot production in 1925 was 44,186,977 gross tons, or a trifle more than predicted a month ago, and 1.3 per cent above the previous record, made in 1917, but very closely approached in 1923. More important is the fact that production in the last quarter was at a rate of about 47,000,000 tons per annum, and present prospects are that this quarter will do somewhat better.

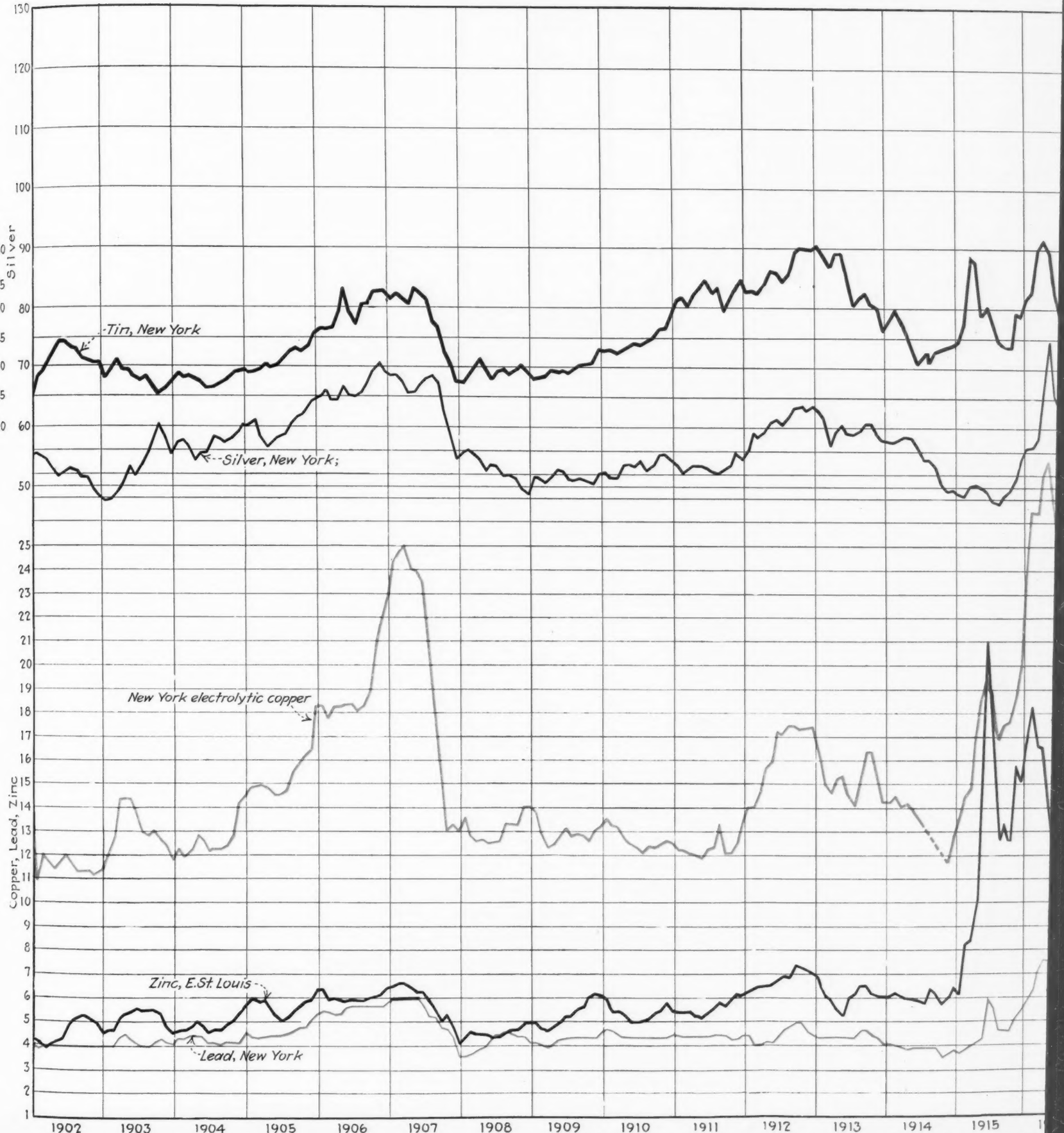
Steel prices are perfectly steady all along the line. A little hardening is expected in a few spots soon.

The Steel Corporation's unfilled obligations increased by 451,584 tons in December, or almost as much as in November, making four months of increases after six months of decreases. The unfilled tonnage Jan. 1 is 5,033,364 tons, equivalent to shipments for more than four months at an 85 per cent rate.

Pig Iron — Market continues dull, with prices easily maintained: Bessemer, $21; basic, $20; foundry, $20.50, f.o.b. Valley furnaces.

Connellsville Coke — Production did not gain as much as expected, and the snowstorm brought extra buying from the East, resulting in a net advance of $1 in the week, with spot furnace coke at $5.50@$6, prepared coke at $8@ $8.50, and foundry coke at $6@$6.50.

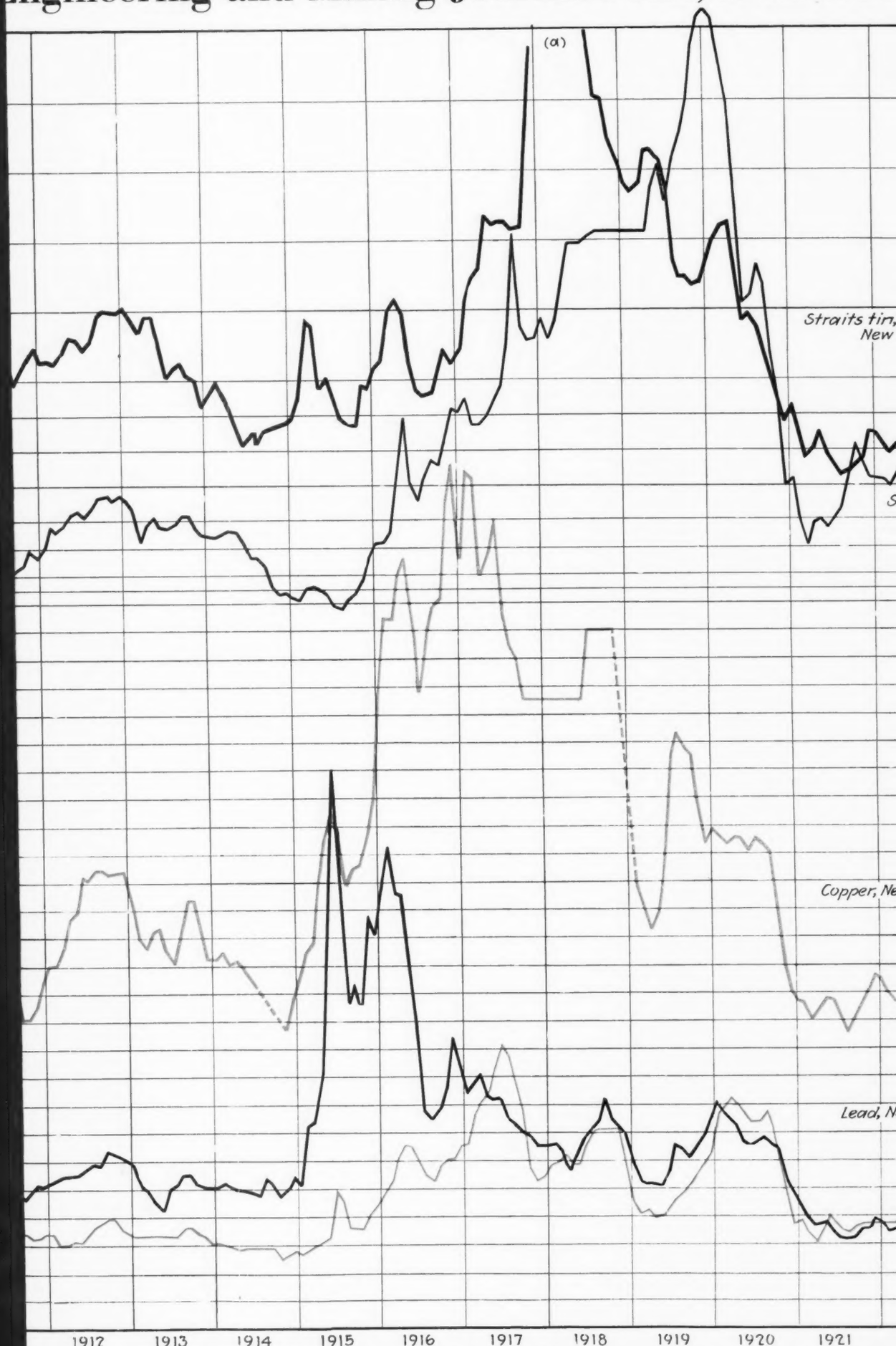
Metal Price Chart of the Engineering and Minin



(a) No Engineering and Mining Journal quotations for this period

Prices of Copper, Lead, Zinc, Ti

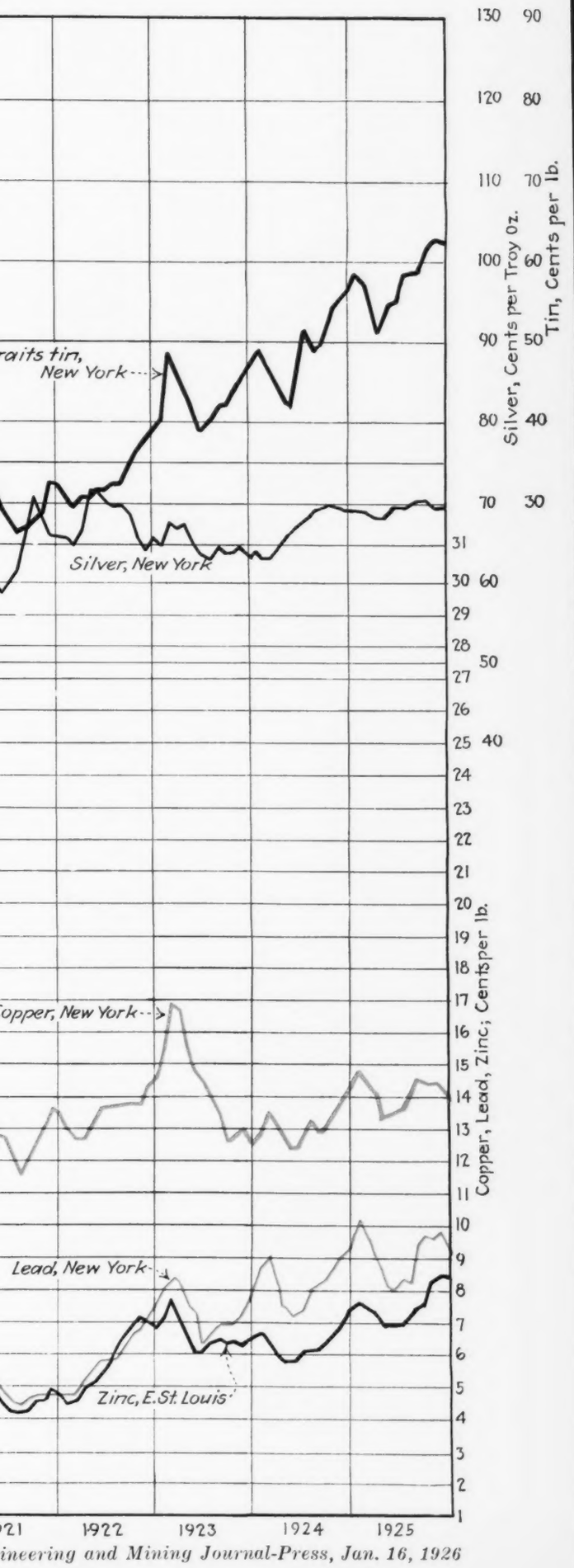
Engineering and Mining Journal-Press, 1902-1925



Copper, Lead, Zinc, Tin and Silver

Supplement to Engineering

1925



Engineering and Mining Journal-Press, Jan. 16, 1926